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Proposed Improvements in the American Machinist for 1902.

The first issue of the month has now become so large that it is no longer possible to "saddle stitch" it together.

Each form of sixteen folded pages will hereafter be gathered on top of another and stitched sideways.

This makes it necessary to use a cover.

This plan will allow the London office to arrange their reading matter on consecutive pages, with the American reading matter on consecutive pages, and their advertising with the American advertising. Beginning with 1902, then, there will be in the American edition but sixteen pages of advertising between the first cover and the reading matter, the reading matter will be all on its own pages; the manufacturing items will not be mixed up with advertising as now.

Following the reading matter will be an index to advertisers and following that a classified index of articles advertised.

This arrangement of the paper makes it more flexible, allows us to add pages later and at the same time close up more forms and get to press with them before the last minute.

It has lately become almost impossible to make up the advertising pages of the paper on account of the special positions claimed by so many of our old advertisers. These positions were never charged for, but were given as an accommodation. Hereafter no special position can be promised except those specified by contract and paid for above the regular rates.

The "American Machinist" employs ad. writers to keep its patrons' ads. right up to date. It varies the size of space, as well as position, when allowed to do so. It firmly believes in putting brains into copy—it's what you say in an ad., not what particular corner of the paper it occupies, that counts.

The reading matter will be increased both in the weekly and monthly issues, the editorial page and contents being moved to the twenty-second page from the front.

The "American Machinist" has no fault to find with itself for the present year. Its regular edition has been more successful than in any previous year.

Its European edition is a great success both financially and in introducing the paper more thoroughly into European shops.

The monthly number secured over 8,000 subscribers over and above the regular weekly issue within the year and without cutting down the weekly issue at all.

For 1902 we expect to publish a larger and better volume than ever before.

Instruction in Drawing by Correspondence and Other Schools.

The letter in another column on "Correspondence School Instruction in Drawing" is worthy of more than a passing notice, especially as its author is in charge of one of the largest drawing offices in the country.

Mechanical drawing, as understood by a designing draftsman and to a student without general mechanical instinct or knowledge, is one of the most difficult of subjects to teach, and to such a student it is at least doubtful if it can be effectively taught at all. As described by its name, however, it is one of the simplest, and this regardless of the student's qualifications. The teacher whose first experience in a drawing office is so graphically described by our correspondent understood it, as do too many teachers, as it is described by its name—that is, she understood it to be a mere matter of a few conventionalities and of nicety of execution. This view of it is fairly comparable to the view of a teacher of penmanship who might suppose that in teaching penmanship he was in fact teaching authorship. Good execution is expected of a draftsman as a matter of course, while good penmanship is not required of an author, and good execution is thus of greater importance to a draftsman than is good penmanship to an author, but the comparison nevertheless holds. Good execution alone no more fits a man for a draftsman's work than good penmanship fits him to write books.

This limited view of drawing is by no means confined to teachers in the correspondence schools. On the contrary, it is at the bottom of most of the criticisms of the incapacity for actual work as draftsmen of graduates from some of our leading institutes of technology. Matters have improved greatly in this respect at many schools, but many exhibitions of student drawings—we recall one not many years ago from the Naval Academy at Annapolis—are still painful things to look at, painful as exhibitions of wasted time and painful as reminders that their makers believe themselves to be draftsmen because they can make straight lines with a ruler and circles with a compass.

To the student possessed of the mechanical instinct—whether natural or acquired through association with machinery and drawings—the case is entirely different. To such a student the "art" of drawing as it is too often taught is the simplest imaginable. The draftsman's point of view is already largely his and a little practice in execution with the criticism of a teacher—whether at his elbow or at a distance makes little difference—is about all that is needed to fit him for a start as a junior draftsman, but to one without this instinct such instruction is practically valueless. It seems to us that an ambitious shop boy who, by seeing and handling them has learned what drawings are like, by comparing them with the things shown has found out what the conventionalities are, and by his own annoyance at their deficiencies and obscurities has discovered what the requirements of good drawings are, should be able, through the work of the correspondence schools, to fit himself to begin useful work at the drawing board. We hear from all sides that there is a famine of draftsmen. Openings are everywhere and, with the correspondence schools in existence the opportunity is everywhere.

We are surprised at our correspondent's statement regarding the ignorance of projection shown by correspondence school students. Many possess an instinctive or an unconsciously acquired knowledge of projection which is sufficient for construction drawings, except perhaps of such subjects as screw propellers and the like, but

many do not, and to a beginner the training in seeing things with the mind's eye which do not in fact exist, resulting from the study of projection is of the first order of importance—of far greater importance than is the solution of the various set problems. The putting of projection problems on paper affords the same opportunity for drill in neatness of execution as that given by mere copy-book exercises, and they should be given a leading place, though projection is a subject which it is easy to overdo.

And it is to be remembered that it is quite possible for a workman to be very much benefited by a course of instruction in drawing, even though such course may not fit him to hold a position as a professional draftsman in a large industrial establishment. The fact is that thousands of drawings are being made every day in the shops of this country, which drawings answer the purpose for which they are made, but whose makers could not hold positions as regular draftsmen nor would they think of applying for positions as such.

Many a toolmaker in charge of a toolroom who is expected to design as well as look after the construction of tools and fixtures finds a knowledge of drafting exceedingly useful or even essential to him and makes drawings that answer every purpose, knowing perfectly well at the same time that he could not pretend to be a professional draftsman. Much the same may be said of department and other foremen in machine shops.

The correspondence system is, we know, of great help to many such men. The promoters of correspondence schools are mostly enthusiasts. They have great faith in the efficiency of their system and this faith is based upon much evidence of good work done. Perhaps their circulars and other printed matter mislead some students, but this is probably inevitable. It is but natural that the proprietors of these schools should base their claims for them upon the best results that come under their observation. They must inevitably deal with much material that comparatively little can be made of; but an important question is whether or not even in these cases enough improvement is not made to justify the expense and time. Even the awakening to the advantages of some education and an honest effort to secure it are usually of some benefit in one way or another.

We have large faith in the work of the correspondence schools, based on some knowledge of it. It may, perhaps, be said with sadness of their students, as of most classes of people, "many are called but few chosen," but that many have found through them a needed opportunity, there can be no doubt.

Marconi seems to have given a new and more extended meaning to the late President McKinley's words, "the period of exclusiveness is past," by the demonstration which he has made of the possibility of sending signals across the ocean without the use of wires. Though it is not yet shown that cables will be superseded, the method is very promising and seems likely to have an important influence upon the social intercourse and international trade of the world.

Trade Secrets and Confidential Relations.

It seems to be the tendency of modern legislation in our older communities to depart farther and farther from the strictness of the Common Law rule which refused to enforce contracts in restraint of trade. Such a disposition is most conspicuously evidenced in the public policy followed toward large combinations of capital, but there are also signs of a relaxation of rigor in the rule as applied to private dealings and minor interests. This is shown in the decision of the Appellate Division of the New York Supreme Court in a case which recently came before it for review.

It appeared that the Magnolia Metal Company had engaged Walter B. Price as traveling salesman on a salary of $7,000 a year, and he had covenanted that in the event of his leaving the company's employ he would not reveal any of their business secrets, nor directly or indirectly engage in a similar business. After his connection with the company had ceased he, according to their allegation, started a rival concern called the Runskool Metal Company, making use of many of the secrets of the Magnolia Company and luring away some of their employees. The Magnolia Company brought suit. The judge of the trial court refused to allow the plaintiff to prove many of the allegations and dismissed the complaint on the ground that the contract was one in restraint of trade. In reversing this judgment upon appeal, Judge Ingraham of the Appellate Division, speaking for the court and after referring to the fact that the plaintiff company had to compete with dealers who manufactured a similar metal, and that Price's position was a confidential one, enabling him to gain a complete knowledge of all the Magnolia Metal Company's customers, says:

"When a person occupied such a position, which enabled him to obtain such information of the plaintiff's business, it was quite essential for the plaintiff's protection that when such an employee left the plaintiff's employ he should not accept a position in which he could use the information thus obtained to injure the plaintiff's business. . . . How essential this covenant was for the plaintiff's protection is established by the conduct of the defendant. He entered the plaintiff's employ with no knowledge of the business conducted by it. Within a short time he had induced the New England representative of the plaintiff, and one of its largest customers, to organize a corporation to compete for its business, and is now the president of such corporation, trying to induce the plaintiff's agents to leave its employ, using the knowledge of the plaintiff's customers, which he obtained while in its employ, to secure them for the new corporation, and thus directly injuring the plaintiff's business by using the business secrets intrusted to him for his own business advantage and to the injury of the plaintiff."

It may be remarked that the old rule as to contracts in restraint of trade inhibited those which were unlimited as to *both* time and place. The significance of the present decision depends somewhat upon whether the contract had been thus unlimited.

It is to be inferred from the Appellate Division's judgment that the old formal anti-monopoly laws will not be allowed to override the enforcement of reasonable measures to defend a company's business from treachery of the wooden-horse type. Even in these days there are many concerns which possess private formulas and processes upon which their ability to meet competition depends. And there are a far greater number who, while guarding no cabalistic secrets, depend for their success upon a system of methods built up by years of experience, and which, though it cannot be explained in words, may be learned by those in the company's employ. At all events most business establishments would feel their interests seriously compromised were their order books and their relations with their customers indiscriminately open to the scrutiny of a competitor. There is nothing to prevent their former employees turning such knowledge against them in default of a positive agreement. The decision in hand increases the likelihood that if such agreement be made it will be enforced by the courts.

In this city a few days ago a 48-inch water main burst under the full head of water, with consequences to the neighborhood that may be imagined. The water of course was shut off as soon as possible, but the time occupied in doing this was the subject of many complaints. As the flow is said to have been entirely stopped in an hour and a half it is tolerably certain that it was accomplished quite as quickly as was compatible with the safety of the pipes behind the gate that was closed. It will never do to stop the flow of water in a large pipe suddenly, and the mechanical devices for operating such gates are always made with worm wheels or other means to compel slowness of movement, and all who have to do with water works are properly impressed either by precept or experience with the necessity of making haste slowly when checking the flow of heavy columns of water.

Commercial Review.

NEW YORK, Monday, Dec. 16.

BIG WORK AHEAD IN ELECTRICAL POWER.

As viewed by the large electrical manufacturing interests, the year 1901 has shown a marked improvement over its predecessor. Contracts closed of the Westinghouse Electric & Manufacturing Company are roughly estimated to have exceeded by from a quarter to a half those of last year and the orders booked by the General Electric Company have run ahead of last year's by some 20 per cent. As regards the latter company, at least, a contraction of foreign demand has been noticed, but it has been more than offset by the expansion of domestic, and prospects are for a further enlargement next year. There has been great activity in mining machinery, even without much help from South Africa. Established lighting companies have evinced a spirit of progressiveness and are replacing their old equipments by up-to-date machinery. Railroad companies have waked up to the advantages of the electrical systems for operating their shops.

The last week has been a red-letter one from an industrial view point. The announcement that the Pennsylvania Railroad will dig a tunnel under the North and East rivers and Manhattan Island to connect its Continental lines with the Long Island Railroad by an electric line insures an expenditure of $10,000,000 to $15,000,000 at the very least, in methods helpful to the public weal, including the construction of a power plant and equipment, while further transportation projects in this vicinity by the same and other companies will indefinitely multiply the amount. The work will necessarily extend over three or more years.

An enterprise like this means a great deal for the industries of the country. If the work attendant upon a world's fair is enough to cause a boom for a nation such a task as the Pennsylvania has set before it must be of no small consequence to the public. It creates business directly it opens up fields for new business and more than all it evidences a feeling of confidence that good business is going to last. Nothing that has transpired for a long time has furnished a better security for several more years of plenty.

As an instrument for carrying out the project above mentioned, the Pennsylvania-New York Extension Railroad Company has just been incorporated. The tunnel will go under the new rapid transit tube, which is far from shallow, and there will be a big subterranean station with elevators at Thirty-second street, Manhattan. This tunnel project does not set a limit to the new enterprises at present undertaken by the Pennsylvania system On the Jersey side of the harbor they have a big task of pier construction along the Greenville shore and they have just purchased a strip two blocks wide cutting across from Newark to New York Bay for freight-yard purposes, while the reclamation of the Hackensack meadows is another gigantic scheme in the same vicinity which may develop a relationship to theirs. On the Long Island side, Austin Corbin's old plan for a line of trans-Atlantic steamships from the eastern end revives in memory, and it is suggested that the American and Red Star lines which are allied to the Pennsylvania road in interest, may make a landing there. If this is not precisely what the Pennsylvania people have in mind, the development of the Island will doubtless carry with it other features of moment to engineers and manufacturers. In cataloging the new projects of the Pennsylvania we must not forget to mention the tunnel through the Alleghenies at Horseshoe Curve.

MACHINERY, MACHINES, AND PARTS OF—	OCTOBER— 1900 Number.	OCTOBER— 1900 Dollars.	OCTOBER— 1901 Number.	OCTOBER— 1901 Dollars.	TEN MONTHS ENDING OCTOBER— 1899 Number.	1899 Dollars.	1900 Number.	1900 Dollars.	1901 Number.	1901 Dollars.
Cash Registers	965	68,034	1,028	91,662	.....	305,567	.....	661,891	9,447	797,650
Electrical	.....	567,610	.....	609,800	.....	2,454,510	.....	4,555,015	.....	4,916,650
Laundry Machinery	.....	35,417	.....	53,503	.....	116,833	.....	411,882	.....	428,801
Metal-working	.....	400,235	.....	266,665	.....	5,522,804	.....	5,546,007	.....	2,373,740
Printing Presses, and parts of	.....	81,980	.....	86,910	.....	788,087	.....	1,066,322	.....	613,208
Pumps and Pumping Machinery	.....	219,452	.....	207,500	.....	2,466,014	.....	2,370,952	.....	1,668,461
Sewing Machines, and parts of	.....	403,391	.....	342,838	.....	3,261,399	.....	3,859,825	.....	3,198,047
Shoe Machinery	.....	62,849	.....	74,190	.....	792,038	.....	888,636	.....	966,059
Steam Engines, and parts of—										
Fire	1	1,500	1	4,085	3	13,713	11	24,078	8	17,635
Locomotive	30	307,304	28	300,155	434	4,272,880	374	3,919,127	378	3,453,445
Stationary	112	64,926	86	87,866	715	387,757	1,123	678,025	1,061	709,244
Boilers and parts of Engines	.....	157,964	.....	162,554	.....	1,136,286	.....	1,619,048	.....	1,251,097
Typewriting Machines, and parts of	.....	267,361	.....	296,252	.....	2,318,011	.....	2,262,228	.....	2,399,313
All other Machinery, and parts of	.....	2,394,121	.....	1,799,443	.....	15,035,015	.....	20,000,052	.....	15,367,281

UNITED STATES EXPORTS OF MACHINERY OF DOMESTIC MANUFACTURE, INCLUDING OCTOBER, 1901.

At Todd's cut in Wilmington, Del., the Pennsylvania proposes to erect extensive shops, besides raising the tracks; on which, all told, it is expected they will spend $5,000,000 or $6,000,000 and have a payroll of $1,000,000 a year. It appears therefore that their various plans now on hand will call for machinery of almost every description—tunnelling, rock drilling, electrical power, passenger elevating, dock hoisting, and, not least important, machine tools.

Almost simultaneously comes news of an enterprise hardly in harmony with the Pennsylvania's—the incorporation of the Trenton & New Brunswick Railroad Company, which proposes to build a third rail road from New York (starting at Stapleton, S. I.) to Philadelphia, on which trains will be run at 75 or 80 miles an hour.

The New York, New Haven & Hartford Railroad Company is about to contract for the electrical equipment of the company's new shops at Readville, Mass. The electric power will represent the equivalent of about 3,600 nominal, or 5,000 maximum horse-power. In the Readville shops there will be 4,000 32-candle power lamps and 210 arc lights. The power station will be located half a mile from the shops. The company furthermore intends to equip its road at Boston, known as the "Belt Line," with electricity. It is reported, by the way, that a part of the Pennsylvania's tunnel scheme is a connection with the New York, New Haven & Hartford by a bridge across the East river from Long Island.

We learn that the contract for rolling stock equipment for the New York Rapid Transit Subway is now liable to be closed up at any time. The New York Central has not yet decided to take its trains through its Black Hole of New York by electricity, but the equipment is already being counted upon in the electrical machinery market. Since the statement by President Cassatt of the Pennsylvania that "after years of exhaustive study the conclusion has been reached that a tunnel operated by electricity is in every way the most practical, economical, and the best both for the interests of the railroad company and of the city," officials of the Central may be influenced to consider more favorably the feasibility of that system, although their case is not parallel and ventilation with the retention of steam power may be the solution in their case.

STEAM TURBINES OF 5,000 KILOWATTS.

If the transportation projects in this vicinity have the greater interest to engineers from a commercial standpoint they are perhaps exceeded in technical interest by another announcement of the last few days. Charles T. Yerkes, the Chicago railway magnate who is setting himself to reform one of the London underground railway systems on the American plan, has awarded a contract to the British Westinghouse Electric & Mfg. Company for four turbo-alternators—generators of

5,000 kilowatts each and steam turbines corresponding. No steam turbines of one-third the power of these have ever before been constructed. The undertaking marks a forward step in this line of engineering comparable with the design of the first Niagara Falls generators at the time they were constructed. The new plant at Manchester is not yet ready to undertake this work—although it is hoped to be in full swing before many weeks—and as the contract is an urgent one the expectation is to construct at least a part of the equipment called for at Pittsburgh.

MACHINE TOOLS AND MISCELLANEOUS.

Machine tools are selling in the local market in a way not to be called eventful, but rendered entirely satisfactory by the multitude of small and mediocre orders. A few signs of let-up for the holiday period are manifest in this as in other lines, but the present December is far from being a dull month, even judged by year as a whole. In fact, as a seller of twenty years' experience remarks, December is accustomed to turn out better than is expected of it. It is a better month than January.

Although quite a number of the trunk lines running into New York are now in an interesting state as regards machine-tool contracts, not much seems to have been done locally in the last few days toward closing them up. The Erie, however, has bought a few tools here and there—lathes, planers, a boring mill, radial drill, etc. The Lehigh Valley Railroad, which is now in the market for machine tools, is said to have made plans for a locomotive and car building and repair shop above Chain Dam, near Easton, Pa. The plant is to cost $2,000,000. The present shops in Easton will, according to this, be razed and the site converted into a yard. There is also talk of the company's building general repair and erecting shops at Allentown.

Since it became known that the Ingersoll-Sergeant Drill Company's works at Easton, Pa., were inadequate for the company's increasing business and that the concern would have to build larger, many reports and counter-reports have circulated as to the selection of a site. The latest is that the company has purchased 50 acres at Easton, across the river from their present plant, and will there build works to employ 3,000 men. Attempt was made to-day to confirm this at the New York office, but the official who could speak authoritatively was out. The report has, however, more the appearance of substantial accuracy than some of the previous ones.

Referring to our statement on page 1303 as to a proposed consolidation of pneumatic tool manufacturers, chiefly confined to the Duntley interests, this information is confirmed by subsequent intelligence. The new concern will probably be incorporated in New Jersey and called the Chicago Pneumatic Tool Company. It will embrace the companies already mentioned and also the Chisholm & Moore Manufacturing Company, of Cleveland, Ohio.

The Binsse Machine Company, Newark, N. J., has appointed as agents for the British Empire, Ludw. Loewe & Co., 32 Farringdon Road, London, who will have one of the company's horizontal boring mills in practical operation at their store.

The tool-building firm Flather & Co., Nashua, N. H., has been dissolved and the corporation Flather & Co. (Incorporated) has been organized to carry on the business. It will collect all accounts and assume all liabilities of the firm.

Reeves Pulley Company, Columbus, Ind., manufacturer of the Reeves Variable Speed Transmission, reports a most healthy condition of trade in this branch of its factory, the large number of orders recently booked making it necessary to operate this department thirteen to fourteen hours per day. The paper industry has opened up an unlimited field for the application of the larger sizes, and for the handling of these massive machines the company has recently added quite an extensive addition to its works.

CHICAGO MACHINERY MARKET.

For that large and growing activity in power and general shop equipment, which is preliminary in its nature, this is the favorite season. There have been Decembers, in which sales ranked high among the records of the months, notably the December of 1899, but the rule is for purchasers to obtain preliminary estimates about this time, to be submitted to official board meetings in January, or to make preliminary arrangements in readiness for quick action after the turn of the year. Among engine and boiler men expressions are now heard with great frequency that business for 1902 is to be a continuation of that of 1901 and these opinions are based upon the present volume of inquiries. The month, so far, has been one notable for the number and size of the inquiries, rather than for actual transactions, though there has been no marked deficiency of the latter, even gaged by the standards of this year.

There is an almost complete upheaval in the installation of equipments of industrial plants, the end of which does not appear in sight. Railroad shops in the West are being revolutionized. A few years ago they were out of date and have not only had to keep pace with improved business conditions since, but to make liberal provisions for the future. They are still buying largely of every class of shop equipment. And the same conditions permeate all branches of trade with no noticeable exceptions. A very large percentage has reference to electrical installation of power ranging from the Corliss of 5,000 horse-power down to the requirements of the small manufacturer, whose payrolls include only a few names.

The Chicago office of the Allis-Chalmers Company has sold twice the engine capacity this year that it did in 1899, and from present indications the business of 1902 will be even greater. Among recent orders are the following: Citizens Electric Light and Power Company, St. Louis, three engines of 5,000 horse-power and two of 2,500 each, a total of 20,000 horse power, all to be placed in a new plant which has plans for an ultimate equipment of 100,000 horse-power; Peoria Gas and Electric Company, an engine of 1,200 horse-power; also smaller engines to the Manville Covering Company, Milwaukee, Racine Knitting Company, Racine, Wis., and many others.

The Skinner Engine Company, of Erie, Pa., are placing a number of engines in this territory, ranging from 250 horse-power down. Recent sales are made to the Genoa Electric Lighting Company, Genoa, Ill.; the Fair, Chicago; an engine for the Court House, Milwaukee, and others.

The Bates Machine Company, Joliet, Ill., are running full time and are booked ahead for many weeks for engines of widely varying capacities.

Quotations.

NEW YORK, Monday, Dec. 16.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$16 65 @ $17 15
No. 2 X	16 15 @ 16 65
No. 2 plain	15 65 @ 16 15
Gray forge	15 00 @ 15 25

Alabama Pig, New York delivery:

No. 1 foundry, or soft	15 75 @ 16 50
No. 2 foundry, or soft	15 25 @ 15 75
No. 3 foundry	14 75 @ 15 25
Foundry forge, or No. 4	14 25 @ 14 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots. From store, 1.90 @ 1.95c. in small lots. These prices are on the assumption that no change was made at Saturday's meeting of the mill men. Several sellers in town were consulted to-day, but they had not received information on the subject.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c.

Copper—Break has come. Prices unsettled. Lake ingot in carloads approximately 15 @ 15⅝c.; electrolytic, 14¾ @ 15¼c.; casting, 14½ @ 15c.

Pig Tin—In 5- and 10-ton lots f. o. b., New York, 24¾ @ 25¼c.

Pig Lead—For wholesale lots, 4⅜c., with .02½ @ .05c. extra for carloads.

Spelter—4.30c., New York delivery.

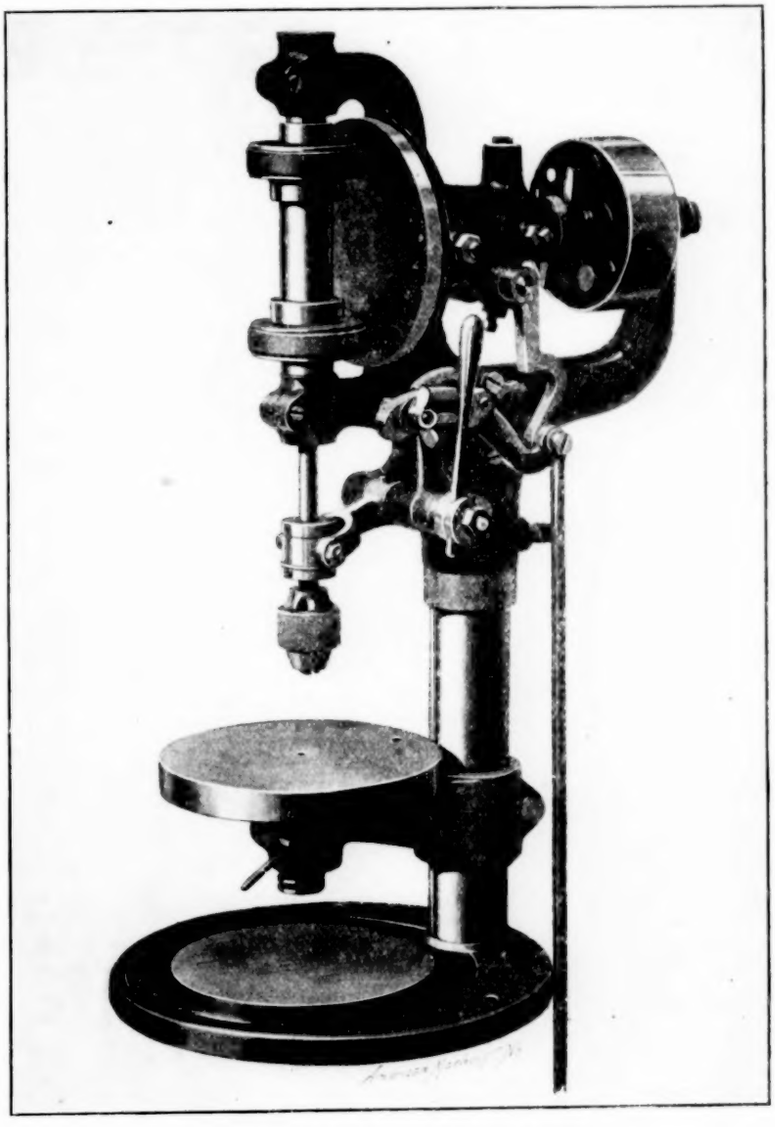
Antimony—Cookson's, 10¼ @ 10½c.; Hallett's and U. S., 8¾ @ 8⅞c.; Italian, 7¾ @ 8c.

Lard Oil—Prime City, 79 @ 82c., in wholesale lots.

The Lambert Vertical Tapping Machine.

The little machine here shown is for tapping holes from the smallest sizes up to ¼ inch in diameter. It will tap either through holes or with the tap bottoming at any predetermined depth. The tapping spindle is rotated in either direction by the two friction wheels alternately in contact with the large disk immediately behind them. The horizontal sleeve in which the disk shaft runs is pivoted on two horizontal screws just behind the disk, and by the action of the levers the disk is tilted enough to bring either the upper or the lower portion of the disk face in contact with its friction wheel and to run the tap-carrying spindle in either direction accordingly. Adjustable screws at the back limit the tilting of the disk and the consequent amount of friction in the drive, so that delicate taps will not be broken. On account of the tilting of the disk, and the vertical movement of the rear end of its shaft, the driving pulley is separately mounted, but normally in line with it, two pins projecting from the face of the pulley engaging with two arms on the disk shaft. The tapping speed may be changed by moving the friction wheels up or down the vertical sleeve, thus changing the radius at which they contact with the face of the disk.

The lever which tilts the disk is a square arm hanging straight down with a square corner at the bottom, and near the bottom a branch goes out at the back with a downward bend ending in a straight piece standing obliquely. A shaft mounted in front carries a fork with a collar by which the tapping spindle is moved up and down. On the same shaft is a quadrant with a curved slot in which is a pin with a thumb nut by which it may be adjusted. Outside on the same shaft is an adjustable hand lever, and a rod for a treadle can be attached at the back, so that the quadrant may be operated either by hand or foot. The movement of raising the spindle carries the quadrant backward, and a pin strikes the slanting part of the tilting lever, carrying it backward until the upper friction wheel is driven by the disk in the tapping direction. A latch here engages the lower end of the tilting lever and holds it in this position. Moving the quadrant forward a sufficient distance brings the thumb-nut pin in contact with the other end of the latch, raising it and releasing the tilting lever, when the end of the disk shaft sleeve drops, the other friction wheel is engaged and the rotation of the spindle is reversed. There is a sliding cross pin, not visible, which when pushed in prevents the quadrant being brought far enough forward to operate the latch, and then the spindle runs constantly in the same direction and may be used for drilling. While the machine is supposed to be usually for right-hand tapping, it can be run as well for left-hand work by simply crossing the belt, and for this the pulley may easily be slipped out and in again without unlacing and relacing the belt. The entire head of the machine is adjustable up and down the column, and by this means the tension of the belt may be corrected. The base and the column are in a single piece. The table bracket is movable up and down the column, and the table screws up and down in the bracket, all being easily secured at any point desired. All the bearings and spindles are of tool steel, hardened, ground and lapped to fit. The weights and end thrust of the spindles have rollers or ball bearings throughout. The work of the operator of this machine, so far as the machine is concerned, is simply that of engaging or starting the tap into the hole; it will then go of itself to the adjusted depth and reverse automatically. The tapping spindle being perfectly balanced and free from side driving thrust, the smallest tap can be used without danger of breakage, and the softest material can be tapped without stripping the thread. The diameter of the tapping spindle is ½ inch, with a 5-16 inch Almond chuck, and a sliding motion of 1½ inches. The diameter of the friction pulleys is 3 inches, and of the disk 6½ inches. A countershaft with tight and loose pulleys goes with the machine. Larger sizes of the machine are to be made. It is built by Montgomery & Co., 105 Fulton street, New York.



THE LAMBERT VERTICAL TAPPING MACHINE.

Contagious Invention.

A correspondent of the "American Machinist" relates a number of instances where invention has been "contagious"; that is, where the same idea has occurred to different people who have had no opportunity of copying from one another. We have met several similar instances of simultaneous invention in mill machinery appliances. Two men hundreds of miles apart worked out the same mill stone dress. A device which at one time enjoyed a popularity as a first break, occurred to two men, one of whom secured a patent. The idea of magnets for separating metallic substances from grain, through the

introduction of the old wire binders, and the awful havoc that the bits of wire made in the mill's bolting cloth, was suggested in several quarters simultaneously. This last is an obvious invention, some will say, but nobody who remembers how millers tore around and anathematized the wire binder and the little flat knives that the millstones made of the bits of wire will say so. The trouble lasted a long while before the simple expedient of gangs of magnets was thought of.—"American Miller."

Experiments on the Flexure of Beams—Discovery of New Laws—II.

BY ALBERT E. GUY.

THE DEFLECTION OF THE BEAM.

This is indeed a most valuable auxiliary. It should be remarked, however, that the problem as stated contains no reference to it, and is thus in conformity with the majority of questions on strength of materials. In practice the deflection is not considered as much as it should be, and, while in many cases it deserves the first place in the calculations, it is too often neglected: attention being paid only to the strength of the parts. In machine tools, for instance, strength is secondary to rigidity; but it is hardly necessary to state that, when rigidity is obtained in a solid, strength is generally ample and the factor of safety satisfactory.

The vibrations which are so objectionable in machine work should be minimized by making the parts very rigid—that is, by reducing as much as possible their deflection. It seems, then, that the general adoption of standards of rigidity would prove very beneficial.

When we consider the allowable stress f in bending we give it a value depending on the conditions under which the load is applied, viz., dead load, moving load, load causing alternative stresses of tension and compression, etc. Similarly, the deflection could be made a fraction of the length of the beam and given a value corresponding to the degree of rigidity required. Thus for general work, Weisbach ("Theoretical Mechanics," eighth edition, page 470) advocates making the deflection:

$$d = \frac{1}{500} \cdot L = n L$$

L = length of beam in inches for d in inches.

It is only necessary to agree upon a few practical values of the quantity n to establish standards which, like the values of f, will not be binding but will simply indicate the limits suitable to certain conditions of work.

The deflection formula applicable to our problem is:

$$d = \frac{1}{m} \cdot \frac{PL^3}{3EI} \qquad (5)$$

where

E = modulus of elasticity of the material;

I = moment of inertia of the section resisting the greatest bending moment PL;

m = co-efficient depending upon the shape of the beam

By comparing equations (1) and (5) we remark that they have some common factors:

$$(1) \ldots Px \text{ or } PL = f \frac{I}{a}$$

$$(5) \ldots d = \frac{1}{m} \cdot \frac{PL^3}{3EI}$$

By combining both we obtain:

$$d = \frac{1}{m} \cdot \frac{f}{3E} \cdot \frac{L^2}{a} \qquad (6)$$

At last here is something tangible! Knowing from the nature of the work expected the desired amount of rigidity of the parts, we may express d as a function of the length, and since a for a rectangular section is equal to $\frac{h}{2}$, we have:

$$d = n L = \frac{1}{m} \cdot \frac{f}{3E} \cdot \frac{L^2}{\left(\frac{h}{2}\right)}$$

whence:

$$h = \frac{2}{3} \cdot \frac{1}{m} \cdot \frac{f}{E} \cdot \frac{L}{n} \qquad (7)$$

Thus the hight of the section is comparatively determined, for all the factors are known quantities. The co-efficient m is somewhat embarrassing to determine; it varies, as previously stated, according to the shape of the beam. If the beam is of rectangular section throughout its length, $m = 1$. When the hight h of the beam remains constant throughout the length the width b tapers gradually and becomes zero (theoretically) at the loaded end and $m = \frac{2}{3}$. If the width b remains constant throughout the length h diminishes to zero at the loaded end, and the longitudinal elevation of the beam is a surface limited by two parabolas or by a straight line and a parabola; then $m = \frac{1}{2}$. In these two last cases the beam is of uniform strength.

It is understood, of course, that this co-efficient can be determined for any solid by solving the general equation:

$$\frac{d^2 y}{dx^2} = EI,$$

which is given in text books. But usually the beam is sketched roughly on the design so that an approximate value can be assumed for m. In beams of uniform strength when rigidity is required this value is rather nearer $\frac{2}{3}$ than $\frac{1}{2}$.

If the chosen section is rectangular we have gone now as far towards solving the problem as the known formulas permit. It is true that judgment must be exercised in choosing a value for m, but the limits of variation of this factor are known and the task is easy for an experienced man. The hight h once found, b is thereby determined for the maximum section at point of support and, a convenient number of sections being calculated at different points of the length, the shape of the beam is delineated. If the degree of rigidity required is very great and the beam very long, the hight may be so great that the beam, if designed according to formula (1), will be very thin and consequently apt to bend or warp laterally. Therefore another form of section must be adopted which will insure rigidity and stability as well as economy of material.

When the material composing the beam is isotropic the most economical is the box or I section. We can find the required hight of the maximum section by using formula (7), but what must be the width b, the thickness of the top and bottom flanges and of the web? And these questions once settled through "judgment," how can the shape of the beam be delineated without employing the tedious process of calculating a great number of sections at points along the length of the solid?

When so much trouble is encountered in dealing with the simplest case, it seems impossible to delineate satisfactorily the irregular forms of sections. We have now examined the most important points advanced by the "Theory" and we have found that the consideration of the deflection of the beam is the only matter which has helped toward the solution of the problem; but our task is far from being completed and we are left in the midst of such difficulties that we can realize, at present, that many practical men have some excuse for sneering at such an incomplete "theory" and prefer to solve the question by "cut and try" methods. The timely arrival of our experimental data brings the proper light into the subject, establishes the Theory of the Flexure of Materials upon a firmer basis and helps to make it a science.

EXPERIMENTS.

A beam subjected to bending is divided into two distinct parts by an imaginary neutral plane passing along the longitudinal axis of the beam. Each part is subjected to stresses which vary directly, in any transverse section, as the normal distance from the neutral plane to any point of the section. Both maxima stresses are consequently located at the points farthest from the neutral plane.

The resistance of a solid to tensile stress is directly proportional to the area of its section, but is independent of the form of this section.

Generally the resistance to compression is considered in two ways: 1. When the length of a solid is less than a certain multiple of the least dimension of its transverse section it is common in practice to admit that the resistance is directly proportional to the area of the section; 2. When the length is greater than the said multiple the solid tends to give way by buckling.

Since the length of a beam subjected to bending is usually very great as compared with its width of section, and as in ex-

treme cases it has been observed that thin beams gave way by buckling or warping laterally in the compression part, it seems that this latter should not only be given the necessary area to resist the compression, but should also be provided against buckling. In fact, the whole beam is something like the combination of one rod and one column. Why not treat the rod for tension and the column for buckling? This interpretation once admitted numerous facts gathered from records of experiments on bending came forth to strengthen it. We see, for instance, in "Navier's Work on Resistance of Solids" (revised by de Saint Venant, page 113, Vol. I) that Mr. Ferdinand Zores made, in 1850, some experiments upon rolled beams. Mr. Zores remarked that symmetrical I-beams supported at the ends and loaded at the middle always gave way by the buckling of the compression part, while the tension part was not altered. The beams were afterwards made with a reinforced compression part, with a view to remedy this defect; their resistance was somewhat increased, but they buckled the same as before. It was then remarked that the lateral bending was very similar to that of columns loaded on ends. General Morin also cites some similar cases in his "Résistance des Matériaux."

Mr. de Saint Venant almost pointed out the right solution of the question by stating (page 139 of Navier's work) that the resistance of a beam to buckling depends upon the ratio $\frac{I_1}{I}$ of the two principal moments of inertia of its section. But his subsequent analysis is incomplete because he considers only the section of the beam and does not take the length into account.

It remains to prove the correctness of the interpretation just advanced. As it will be seen presently, the experiments undertaken prove it very clearly.

Of all materials available for making tests, wood possesses so many good qualities that it is usually preferred to any other. Thus, I employed in my experiments strips of white pine carefully selected and free of imperfections. The modulus of elasticity of each was ascertained by the ordinary method: a strip of rectangular section being placed horizontally upon two supports and loaded at the middle with a known weight, the deflection or vertical displacement of the center of the strip due to the load was measured, and, all the symbols being known, the symbols were replaced by their values in the general formula, which was then solved for E, the modulus of elasticity. For a beam of constant section throughout supported at the ends and bearing a uniformly distributed load P_1 and a single load P at center the deflection is:

$$d = \frac{L^3}{48\,E\,I} \cdot \left(\frac{5}{8}P_1 + P\right) \qquad (8)$$

This deflection is composed of that d_1 due to the uniformly distributed load P_1, which is here equal to the weight of the beam, plus that d_2 due to the single load P. The formula can be written thus:

$$d = d_1 + d_2 = \frac{5}{8} \cdot \frac{P_1 L^3}{48\,E\,I} + \frac{P L^3}{48\,E\,I}$$

The deflection d_1 itself need not be measured, but if d_2 is ascertained we have:

$$d_2 = \frac{P L^3}{48\,E\,I}$$

whence

$$E = \frac{P L^3}{48\,d_2\,I}$$

I is the moment of inertia of the section of the beam referred to an axis passing through the center of gravity of the section and perpendicular to the direction of the load.

The plan adopted for tests was as follows: A beam of rectangular section of base $= b$ and hight $= h$ was placed horizontally upon supports and loaded at center. In every case h was several times larger than b. *The load was slowly increased until the beam suddenly bent or warped laterally, and becoming unstable would have fallen from its supports—had not preventive means been provided—but without breaking at any place.* This test was repeated twice more and the maximum load recorded. The distance between supports being shortened by one inch on each side of the center (totally by 2 inches) a new maximum load was recorded, and so on until the strip gave way by breaking across at the point of application of the load (where the bending moment was greatest). This gave the variation of the load corresponding to that of the length. Then another strip was tested, it having the same hight h as the preceding one, but a different thickness b. This strip was treated in the same manner as the first one, and, the results being compared, the law governing the variation of the load for different thicknesses was found. Finally, a strip of the same thickness b as the first but having a different hight h was tested similarly to the others. The results again compared with the previous ones, gave the law governing the variation of the load for different hights.

The results observed in the first three tests were repeated with a remarkable constancy in all the others in such a manner that, for a number of tests, the loads were calculated in advance, and the subsequent experiments proved the correctness of the provisions. The laws found are:

1. *The load is inversely proportional to the square of the length* L *between supports.* Thus, if P and P_1 are the different loads applied at the center of one beam, the distances between supports being respectively L and L_1, we have:

$$\frac{P}{P_1} = \frac{L_1^2}{L^2} \qquad (9)$$

2. *The load is directly proportional to the cube of the thickness* b *of the beam* Thus two beams of the same length L between supports and of the same hight h but of different thicknesses b and b_1 will bend laterally or warp under the respective loads P and P_1, and we have:

$$\frac{P}{P_1} = \frac{b^3}{b_1^3} \qquad (10)$$

3. *The load is directly proportional to the hight* h *of the beam.* Two beams of same thickness b and same length L between supports but having different hights h and h_1 will warp under the respective loads P and P_1, and we have:

$$\frac{P}{P_1} = \frac{h}{h_1} \qquad (11)$$

The three laws combined into one are represented by the equation:

$$\frac{P}{P_1} = \left(\frac{L_1^2}{b_1^3\,h_1}\right) \cdot \left(\frac{b^3\,h}{L^2}\right) \qquad (12)$$

If we multiply and divide the second member of the equation by 12, its value is not altered and it may be written:

$$\frac{P}{P_1} = \left(\frac{12}{b_1^3\,h_1} \cdot L_1^2\right)\left(\frac{b^3\,h_1}{12} \cdot \frac{1}{L^2}\right) \qquad (13)$$

But $\frac{b^3\,h}{12}$ is the moment of inertia of a section referred to an axis parallel to the hight h and passing through the center of gravity of the section. The same remark applies to $\frac{b_1^3\,h_1}{12}$, therefore:

$$\frac{P}{P_1} = \frac{L_1^2}{L^2} \cdot \frac{I}{I_1} \qquad (14)$$

Which shows that the load is directly proportional to the least moment of inertia of the section and inversely proportional to the square of the length between supports. For two beams of uniform sections $b\,h$ and $b_1 h_1$ we have also:

$$\frac{P L^2}{P_1 L_1^2} = \frac{I}{I_1}$$

and for one beam subjected to different load P and P_1 at the respective distances L and L_1

$$\frac{P L^2}{P_1 L_1^2} = \frac{I}{I} = 1,$$

whence

$$P L^2 = P_1 L_1^2 = \text{constant}.$$

Consequently, if for a certain length L it is found that a load P causes the beam to give way laterally, the expression just established permits to determine in advance the deflecting load P_1 corresponding to any length L_1, or $P_1 = \frac{P L^2}{L_1^2}$.

This deduction has been fully confirmed by the experiments. A cursory analysis brings out the very important fact that, for any given length, there is a corresponding load which causes the lateral bending. When L is infinitely great (neglecting, of course, the weight of the beam) P is infinitely small, and *vice versa;* but the product $P L^2$ is always a constant, and that, irrespective of the moment of inertia of the section or of the shape of this latter.

Numerous tests of wooden beams of I or T sections have been made by the author, and they proved beyond a doubt the truth of the new laws.

It is, of course, impossible to prove the

expression $PL^2 =$ constant when L is very small, because P becomes so great that the beam would be crushed at the points of application of the load or of support, and the real object of the experiment could not be attained.

There is also a certain value of P corresponding to which the resulting bending moment $\frac{PL}{4}$ just balances the moment of the molecular forces developed in the most strained section of the beam (at the point of application of the load). Then a very slight increase of the load would cause the beam to give way by breaking across at a place situated at or very near the middle of the length between supports. From this it follows that when a beam is loaded in such a manner that

$$PL = 4f\frac{I}{a} = \frac{(PL^2 = \text{constant})}{L}$$

it is just as liable to buckle as to break across.

In this equation f is the breaking strength of the material of the beam and $\frac{I}{a}$ is the moment of resistance of the transverse section.

(To be continued.)

Blanking, Drawing and Half-Wiring.

BY WILLIAM DORAN.

I will endeavor to describe a practical method of constructing a combination blanking and drawing die for the production, in a single-acting press, of a symmetrically formed and nicely finished shell of sheet brass, which is afterwards plated and used as the cover of a piece of tableware. This shell is shown as first drawn in Fig. 1, and the punch and die for reproducing it in Fig. 3. As these shells were to be produced in large quantities, and were required to be duplicate and free from scratches or marks, it was necessary to construct all parts of the die as accurately and durably as possible, and with each working part separate to allow of substituting when any of them became worn or were broken.

After making a pair of sheet-steel templets, one the size and shape of the outside of the shell, and the other its exact duplicate, only one thickness of metal smaller at all points, we were ready to start. The drawing punch J was made first. A piece of cold-rolled stock was then threaded to fit the hole in J, which was screwed on to it, and the outside was turned to within about 1-64 inch of the finish size. The curved face of J was then finished to a templet to the radius shown, and the shape of the outside was turned in, leaving enough stock to grind the finish. The punch was then hardened and slightly drawn, replaced on the threaded arbor and ground to the exact size and shape by a tool-post grinder in the lathe. The points requiring the most accurate finishing are at $X\,X$, as the shell at this point is required to fit tightly the piece on which it is used.

We now tackle the female die or blanking punch G, which is in fact a compound of a blanking punch and a drawing die. A forging of tool steel is chucked and a hole is bored and reamed through it lengthwise for the plunger and knockout F. While still in the chuck, the inside is roughed out and bored as shown, using the compound rest to get the angle desired at $I\,I$, and hand-tooling the rounded corners. The straight portion is bored back the distance shown, ending in a square shoulder at the back. The inside is then lapped and polished. The forging is now removed from the chuck and forced on to an arbor, the stem E is turned to fit the ram of the press, and the back is faced, but the outside of the punch proper is not touched until after the blank is found. The plunger or knockout H is then finished, the face to the radius of the templet. This face acts as the face of the drawing die. An air hole is let through from the back, and one is let through the blanking punch also. The end of the stem F is threaded for adjusting nuts, and the face H is hardened and drawn to a light straw color. The drawing punch and die are now complete, and we are ready to finish the other parts, and make the trial draws to find the blank.

The cast-iron body of the die, after being planed on the back, is fastened to the face-plate of the lathe by four holes tapped into the back. A cut is taken off the face and the inside is bored at $R\,R$, which should be somewhat larger than the blank will be. This can be determined within ⅛ inch at least. A recess is let into the bottom of the inside as a locating seat for the drawing punch J, and a hole is bored and reamed through the center for the spring barrel stud V. The ends of the bolster at $S\,S$ are faced and eight 5-16

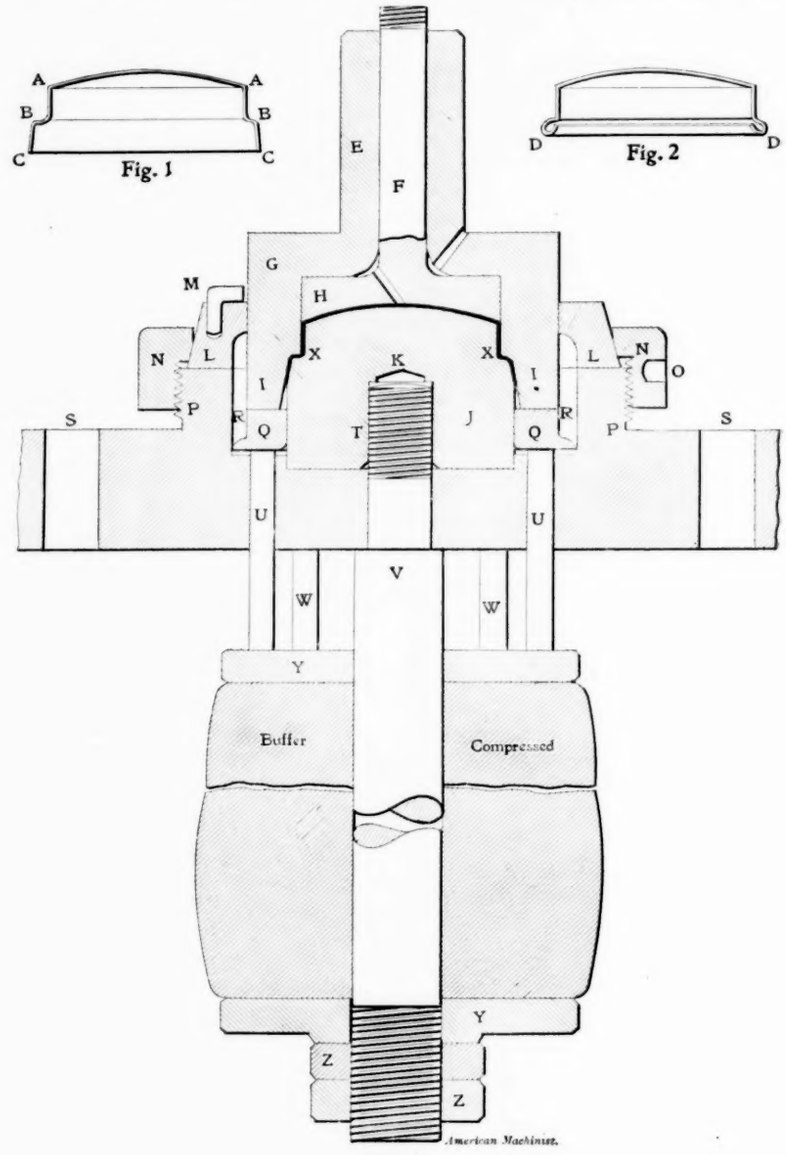


Fig. 1 Fig. 2

Fig. 3

COMBINATION BLANKING AND DRAWING DIE.

inch holes are let through around the inside, for the eight blank holder ring tension pins *U*. The blank holder ring *Q Q* is now got out, and then the eight tension pins, of 5-16 inch drill rod. All the finished parts of the die are now assembled within the bolster as shown, fastening the drawing punch J down in its seat by screwing the spring barrel stud *V* up into it, allowing it to shoulder against the back of the bolster. The tension pins *U* are let down in the holes in the bolster, and rest on the cast-iron washer *Y* of the spring barrel, and the blank holder ring is then placed on top of them. The edge of the hole of the blank holder is rounded so as to come down over the drawing die easily.

The bolster, with the parts mentioned, is fastened on the press, and the punch G, with the plunger *H* in it, is set in line with

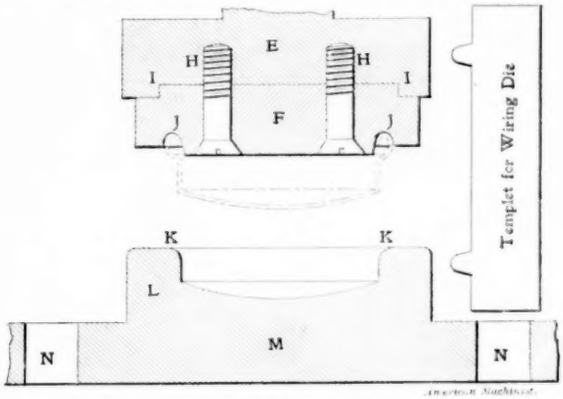


FIG. 4. DIE AND HOLDER FOR HALF-WIRING.

it. The nuts *Z Z* are tightened until the buffer has been compressed sufficiently to hold the blank tightly between the blank holder ring *Q* and the punch *G*, as soon as the blank commences to draw. Now, to find the blank, cut out two or three different sizes of templets in pairs, draw up one of each pair, keep the other, and work from the one which proves the nearest to the size desired, and the blank will be found in very short order.

As we now have the correct diameter of the blank, we can go ahead and finish the die. The blanking die *L L*, chucked by the hole, is faced on the back and the outside is turned to an angle of 10 degrees and then laid aside, and the fastening nut *N N* is finished.

The bolster is now reset on the face-plate, the blanking die *L L* is secured by the fastening nut *N*, the outside of this nut is then finished and the blanking die is bored to within 1-64 inch of the size of the blank templet and the face is finished. The blanking die is now removed and hardened and drawn to a light straw temper. It is again fastened on the bolster, and the inside is ground to the size of the templet and the cutting face ground also, with the tool-post grinder. The hole for the stop or gage-pin *M*, as will be understood, is let in before the die is hardened.

The blanking punch is now roughed down on the outside, hardened and ground to fit the blanking die, the face is ground and the inside is polished by lapping with flour emery. The blanking punch temper is drawn from the back, manipulating it so as to get the cutting edge a very dark brown and the drawing die portion a light straw temper. All the various parts of both punch and die are now assembled, as shown in Fig. 3, and the stop-pin *M* is let in and also four stripping pins. These pins are of 5-16 Stubs wire, and are bent to project over the face of the die to within a fraction of the cutting edge, thus allowing the strips of metal to be fed beneath them.

All parts are now finished and the die is ready for work. It is set up in the press and the rubber spring barrel is adjusted by tightening the nuts so as to hold the blank-holder ring *Q Q* level with the face of the blanking die. The manner in which the blank is punched out and drawn and formed to a finished shell is shown in Fig. 3, the shell being shown by the dark section between the drawing punch and the die. The blanking punch descends until the blank has been drawn from between its face and the blank-holder ring *Q Q*, the tension for holding the blank being communicated to the blank holder by the compression of the rubber spring barrel. The blanking punch is made longer than necessary, to allow of grinding the face. The cutting portion of the blanking die is finished straight for its entire depth, and it also can be ground.

When stock of over 1-16 inch thickness is to be punched the blanking die should be ground shearing. Fig. 3 represents the die as it appears when the blanking punch has reached the bottom of the stroke, and shows how the tension pins are forced down by the pressure on the blank holder, and how they in turn compress the rubber spring barrel by means of the washer *Y*. The locating and fastening of the blanking die upon the bolster by the fastening nut *N N* is the best of several methods, as it allows the blanking die to be removed and ground, and then relocated in the shortest possible time.

The shell as finished in the second operation is shown in Fig. 2. This operation consists of rolling inward and half-wiring the edge. The means used to accomplish this are shown clearly in Fig. 4, and can be intelligently understood with a very slight description. The shell before wiring is placed in the cast-iron holder *M*, the edge of which is rounded to facilitate the rapid locating. The wiring die *F* is of tool steel and fits into a depression in the cast-iron holder *E*. The face of *F* is turned as shown and a V-shaped groove with a half-round bottom of the required radius turned into the face, to match the templet. This groove is lapped to a high finish. When half-wiring a shell the wiring die is set to just descend far enough to wire the edge half way, and when a full-wired edge is desired it is allowed to descend until the edge meets the side of the shell. The one die can be used for either, as the edge follows around on the radius on which it starts.

A British View of American Methods of Manufacturing.*

In dealing with the subject of American *versus* English methods of conducting engineering establishments, I should like in the first place to refer to the preparation and education of boys.

There is danger in England of our taking our boys from school too early in their lives. What is wanted is a more thorough grounding in education and a better knowledge of elementary science. Our member, Mr. Hans Renold, said in his letter to the "Manchester Guardian" some time ago, that in one works in Philadelphia he called at, out of the twenty-nine men in the commercial and drawing offices, nine were graduates of the American Technical College, ten came from manual training schools, and ten came from the high school at which the students must stay till they are eighteen. Now, in England, after a boy has passed the sixth standard, he starts work, very often at thirteen or fourteen years of age, and many boys whose parents can well afford to keep them longer at school start work at fifteen or sixteen.

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Long apprenticeships are not necessary to success in any trade, and it is better for a boy to start work with a good general education, and with the knowledge that he must think, than that he should commence directly he is able to run errands or copy a letter. A boy will make a better blacksmith and a better citizen who starts at the age of sixteen with a sound general knowledge than one who commences work at thirteen and who can with difficulty get through an easy sum in multiplication or long division.

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On arriving at an engineering works in America you are invited to enter and register your name in the book provided for that purpose; you are shown all over the works, the methods of working are explained to you, and new inventions pointed out. The system of showing strangers over works and business houses does not prevail in 2 per cent. of commercial concerns on this side. Yet the Americans are distinctly of opinion that their method undoubtedly pays them from a business point of view.

I called on a firm of constructional engineers in New York, and was immediately shown into the private office of one of the

*Extracts from a paper by Edward Wood, read before the Manchester Association of Engineers.

partners; and after asking him if he would let me see some of their work, he replied: "With the greatest pleasure in the world. Now, let me see: you will like to see some of our twenty and thirty story buildings; all right." Calling to one of his chief assistants, he handed me over to him, and he spent the whole day showing and describing to me their work, their customs, wages paid, and their manner of conducting business. Let me give you my experience on one occasion in Lancashire. A firm of toolmakers wrote to my firm offering a new machine which they were anxious to sell to us. I wrote back saying that before buying I should like to see it at work, and after a few days' delay the makers wrote saying that they had two machines working at two bridge works like my own, but the owners regretted their inability to let me see them, as I was a competitor of theirs.

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One of the most striking features of all the engineering works in America is the fact that quite young men are in positions of importance and trust.

In one large works where I called at, where about 5,000 men are employed, a man was pointed out to me as the chief electrician. "Why," I said, "he is only a boy!" "Boy, indeed!' said my friend; 'he is twenty-four years old."

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Another system that prevails in American establishments is to duplicate, or to have understudies for all important positions. I met a man who had been representing a firm of American engineers at the Paris Exhibition, and who was just on the point of setting out for Australia to open a branch there, and on my asking what would happen to his work if he were taken ill or incapacitated, he replied: "There are a dozen men in our office who could take up my work at twenty-four hours' notice."

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It is the custom for the engineers in America to make everything they possibly can to their own standard or templet. If they get an inquiry for something not in their catalog, they refer you to some other manufacturers. They make a great point of having very good men as inspectors, whose duty it is to pass machinery and work of every description before it is sent off, and the shipping department will not allow anything to leave the works till the inspector has signed a certificate that all is right.

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The drawing office is one of the departments in both English and American workshops which should receive the most careful attention of the firm. Mr. Henry Webb seems to have fully grasped this when he stated in his paper to this society three years ago what every engineer now fully recognizes—viz.: that draftsmen should remember that a drawing should be complete, for a drawing that requires any expanation is little or no use. Drawings for the works should be so clear that they could be sent 1,000 miles away, and skilled men could execute the work at that distance just as well as the men who could confer with the person who made the drawing.

In a modern engineering works such as the Pencoyd Works in Philadelphia (where the Atbara Bridge was made, and which created such a great sensation), the plan adopted is to handle the material as few times as possible.

Here the material literally goes in at one end as pig iron, and after passing through the various stages and departments, comes out at the other end a complete bridge, marked and ready for erection. Here they have steam power, electricity and pneumatic, and hydraulic power.

Thorgh the output has been very much increased during the past few years, the number of men has decreased, machinery taking the place of hand labor. Every possible new machine or method that can be found to save labor is at once seized, regardless of first cost.

The wages of the skilled workman in America is at least twice as high as that paid in England or Scotland, and piece work seems to be very general. The cost of living, however, is so much higher in America that this, in the opinion of many workmen, almost balances the extra amount received in wages.

The houses for the workpeople, which are chiefly made of wood, are nothing like as good as those in this country, and house rents are very high.

All nationalities are found in almost every large engineering works, and the workmen readily acknowledge that it is the dollars that fetch them, coupled with the fact that there are fewer restrictions in America than in Europe.

Considering the great outcry there was some years ago against the introduction of machinery, it is a singular fact that every year there migrate from England—a country with little machinery compared with the United States of America, which is a country full of machinery—thousands of skilled mechanics; and it is a curious fact that here, where we do so much by hand, our workmen receive much lower wages than they do after a few months from landing on the other side of the Atlantic. It is stated by one writer that high up, occupying the best posts in the American factories, you find Englishmen and Scotsmen who left home because they were not content with the dead level of wages thrust on them by trade unions, or with the lack of opportunity given them by their employers.

. . . . . .

There are less restrictions as to piece work, etc., in America than in England. They do not say in America you may have piece work in one shop, and in another you may not, the consequence being that each workman acts on his own initiative, and turns out as much work and minds as many machines as he can, well knowing that the more he does the larger will be his wages.

Masters and foremen in England are constantly coming across cases of workmen who positively refuse to work overtime, or even a full week, saying, frequently, "Thirty-five shillings a week is quite enough for me. Why should I bother about working fifty-three hours, to say nothing about working overtime, even if it would make my money from forty to forty-five shillings per week?" This state of things, so far as I could find out, is almost unknown in America.

A writer to the "Daily Mail" says that the reason why England is being left behind by American manufacturers is the fact that the British manufacturer regards the inventor as an enemy who is trying to upset his business, while the American is always looking out for something to enable him to get ahead of his trade rival. Mr. Councillor A. H. Scott speaks of calling at a business house in America where a box was kept into which might be put written communications from the workpeople, and he was assured by one of the partners that some of the suggestions had contributed not a little to making the undertaking the largest of its kind in the world.

. . . . . .

We have any number of examples of smart things being done in England. One man in a high position in London, on board our steamer, had left at two hours' notice for a three weeks' business tour in the States, and after all you frequently hear from the Americans themselves the statement that they admire and will have to imitate the quiet repose of the Englishman, and they envy him, his horses, his dogs and his home life. They certainly state that America is not the place to live in if you wish to make old bones.

Theory and Design of Mechanical Brakes—I.*

BY E. R. DOUGLAS.

Brakes are applied to vehicles, prime-movers and machinery to absorb energy by creating frictional resistance and so either to reduce their speed or bring them entirely to rest and hold them stationary. Friction of bearings and other parts aids them in this, and live loads, as weights being raised or lowered, may either assist or oppose the retardation and require to be held after motion has ceased.

An equation may be written between the energy absorbed by the brake and that absorbed or given out by other frictional resistances, moving parts in retardation and live loads. Band brakes, block brakes and axial brakes are used, and they must

*Portions of this article originally appeared as a supplement, issued by the Crocker-Wheeler Company, to their Bulletin on Automatic Brake Motors.

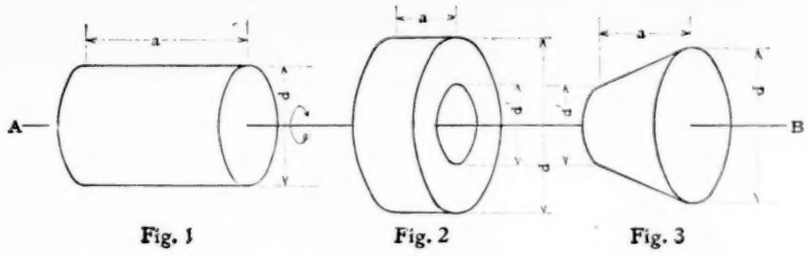


Fig. 1 Fig. 2 Fig. 3

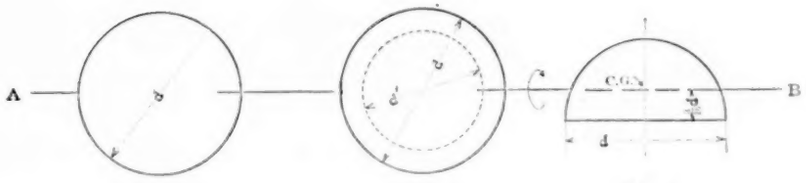


Fig. 4 Fig. 5 Fig. 6

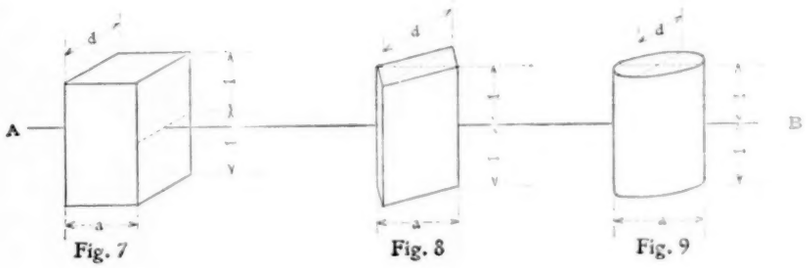


Fig. 7 Fig. 8 Fig. 9

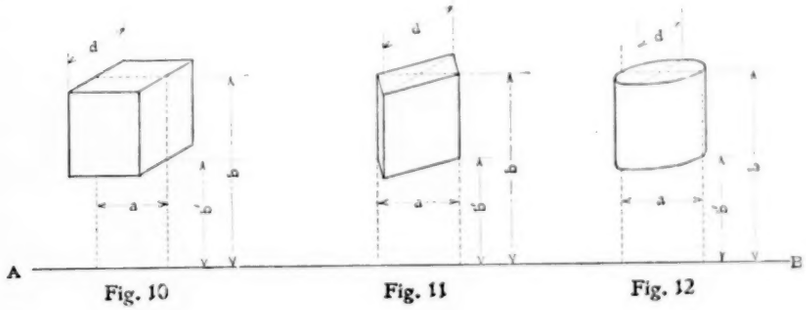


Fig. 10 Fig. 11 Fig. 12

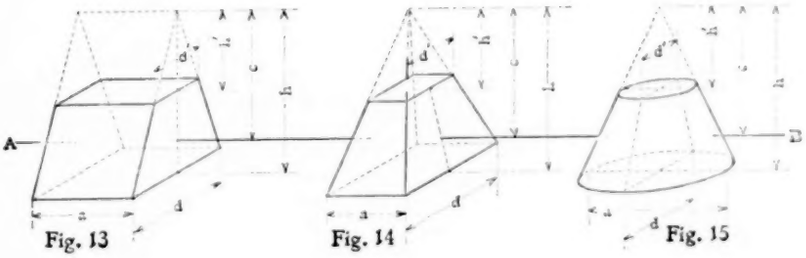


Fig. 13 Fig. 14 Fig. 15

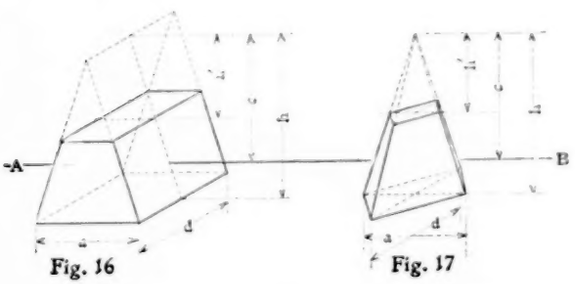


Fig. 16 Fig. 17

ELEMENTS OF ROTATING PARTS.

be considered separately as their modes of action differ.

Kinetic Energy of Moving Parts.—Bodies may possess motions of translation, as in the cases of vehicles, belts, chains, beds of presses or planers, and the like; of rotation, as pulleys, shafts, etc.; or both may be combined, as in car wheels.

For a part weighing w pounds, having a motion of translation of V feet per minute, the kinetic energy in foot-pounds is:

$$H' = \frac{w\,V^2}{7200\,g} = 0.000,004,32\,w\,V^2 \quad (1)$$

where g is the constant of gravity, taken as 32.2.

For a part weighing w pounds and rotating S revolutions per minute, the radius of gyration being r inches, the kinetic energy in foot-pounds is:

$$H'' = \frac{2\,\pi^2}{g}\,w\left(\frac{r}{12}\right)^2\frac{S^2}{3600} = 0.000,001,18\,w\,r^2\,S^2 \quad (2)$$

For a part having a motion compounded of translation and rotation, separate that motion into its elements V and S, find the energies due to each separately by (1) and (2), and add.

Special Cases.—In Figs. 1 to 17 are shown some of the commoner elements of rotating parts of machinery. The volumes, positions of centers of gravity and squares of radii of gyration r^2 are given by the following formulas:

Fig. 1—Solid circular cylinder rotating about its axis. Volume $= \frac{\pi}{4}\,a\,d^2$. Center of gravity at middle point of axis. $r^2 = \frac{d^2}{8}$.

Fig. 2—Hollow circular cylinder about its axis. Volume $= \frac{\pi}{4}\,a\,(d^2 - d'^2)$. Center of gravity at middle point of axis. $r^2 = \frac{d^2 + d'^2}{8}$.

Fig. 3—Frustum of a solid circular cone about its axis. Volume $=$

$$\frac{\pi\,a}{12}\,(d^2 + dd' + d'^2).$$

Center of gravity on axis of which the distance from large end $=$

$$\frac{a}{d - d'}\left(d - \tfrac{3}{4}\,\frac{d^3 - d'^4}{d^3 - d'^3}\right)$$

$$r^2 = \frac{1}{10}\,\frac{d^4 + d^3d' + d^2d'^2 + dd'^3 + d'^4}{d^2 + dd' + d'^2}$$

Fig. 4—Solid sphere about an axis through its center. Volume $= \frac{\pi\,d^3}{6}$. Center of gravity at center of sphere. $r^2 = \frac{d^2}{10}$.

Solid ellipsoid of revolution about its axis. Axial length $= a$. Diameter $= d$. Volume $= \frac{\pi\,a\,d^2}{6}$. Center of gravity at center of ellipsoid. $r^2 = \frac{d^2}{10}$.

Fig. 5—Hollow sphere. Volume $= \frac{\pi}{6}\,(d^3 - d'^3)$. Center of gravity at center

of sphere. $r^2 = \frac{d^2 + d'^2}{10}$.

Fig. 6—Solid hemisphere about an axis through its center of gravity and parallel to its base. Volume $= \frac{\pi d^3}{12}$. Center of gravity at a distance $\frac{3}{16} d$ perpendicularly above center of base. $r^2 = \frac{83}{1280} d^2 = 0.06484\ d^2$.

Fig. 7—Rectangular prism about an axis through its center of gravity, parallel to one of its edges. Volume $= 2\ a\ d\ l$. Center of gravity at middle point of prism. $r^2 = \frac{d^2}{12} + \frac{l^2}{3}$.

Fig. 8—Parallelopiped about a diagonal axis through its center of gravity, parallel to its bases. Volume $= a\ d\ l$. Center of gravity at middle point of parallelopiped. $r^2 = \frac{d^2}{24} + \frac{l^2}{3}$.

Fig. 9—Circular or elliptical cylinder about an axis through its center of gravity, parallel to its (circular) base or to either axis of its (elliptical) base. Volume $= \frac{\pi}{2} d^2 l$ (circular cylinder). Volume $= \frac{\pi}{2} a\ d\ l$ (elliptical cylinder). Center of gravity at middle point of cylinder. $r^2 = \frac{d^2}{16} + \frac{l^2}{3}$.

Figs. 10, 11 and 12 show the same bodies as Figs. 7, 8 and 9, but the axis of rotation does not pass through the bodies.

Fig. 10—Volume $= a\ d\ (b - b')$.

$$r^2 = \frac{d^2}{12} + \frac{b^2 + bb' + b'^2}{3}$$

Fig. 11—Volume $= \frac{a\ d}{2}(b - b')$.

$$r^2 = \frac{d^2}{24} + \frac{b^2 + bb' + b'^2}{3}$$

Fig. 12—Volume $= \frac{\pi}{4} a\ d\ (b - b')$.

$$r^2 = \frac{d^2}{16} + \frac{b^2 + bb' + b'^2}{3}$$

In Figs. 13 to 17 frusta of wedges, pyramids and cones are dealt with, since it is as frusta that these tapering forms are most often met. Should it be desired to apply the formulas to complete wedges, pyramids or cones, h' and d' of course become zero. It is convenient, however, to use the vertex as the point from which to measure distances. If, in any actual case, the hight of the frustum $(h - h')$ and the dimensions of its bases, as d and d', be given, the values of h and h', shown in the figures, may be found by the following formulas:

$$h = (h - h')\frac{d'}{d - d'} \qquad (3)$$

$$h' = (h - h')\frac{d'}{d - d'} \qquad (4)$$

Fig. 13—Frustum of a wedge about an axis through its center of gravity and parallel to edge. Volume $= \frac{a\ d}{h}\frac{h^2 - h'^2}{2}$

Distance of center of gravity from edge $= c = \frac{2}{3}\frac{h^3 - h'^3}{h^2 - h'^2}$

$$r^2 = \frac{1}{24}\left(\frac{d^2}{h^2} + 12\right)\frac{h^4 - h'^4}{h^2 - h'^2} - \frac{4}{9}\left(\frac{h^3 - h'^3}{h^2 - h'^2}\right)^2$$

Fig. 14—Frustum of a pyramid about an axis through its center of gravity and parallel to an edge of its base. Volume $= \frac{a\ d}{h^2}\frac{h^3 - h'^3}{3}$

Distance of center of gravity from vertex $= c = \frac{3}{4}\frac{h^4 - h'^4}{h^3 - h'^3}$

$$r^2 = \frac{1}{20}\left(\frac{d^2}{h^2} + 12\right)\frac{h^5 - h'^5}{h^3 - h'^3} - \frac{9}{16}\left(\frac{h^4 - h'^4}{h^3 - h'^3}\right)^2$$

Fig. 15—Frustum of a circular or elliptic cone about an axis through its center of gravity and parallel to its (circular) base or to either axis of its (elliptical) base. Volume $= \frac{\pi}{4}\frac{a\ d}{h^2}\frac{h^3 - h'^3}{3}$

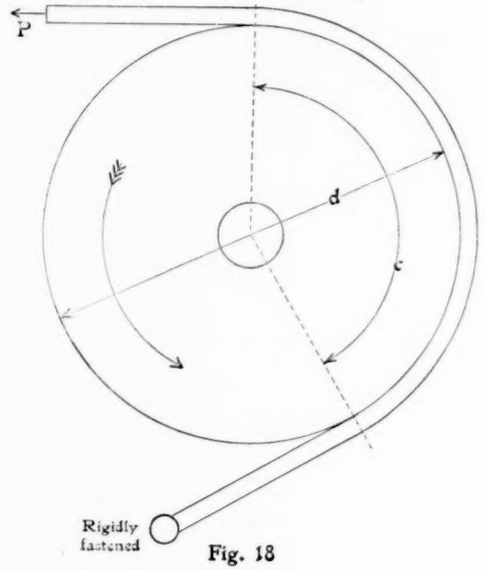


Fig. 18

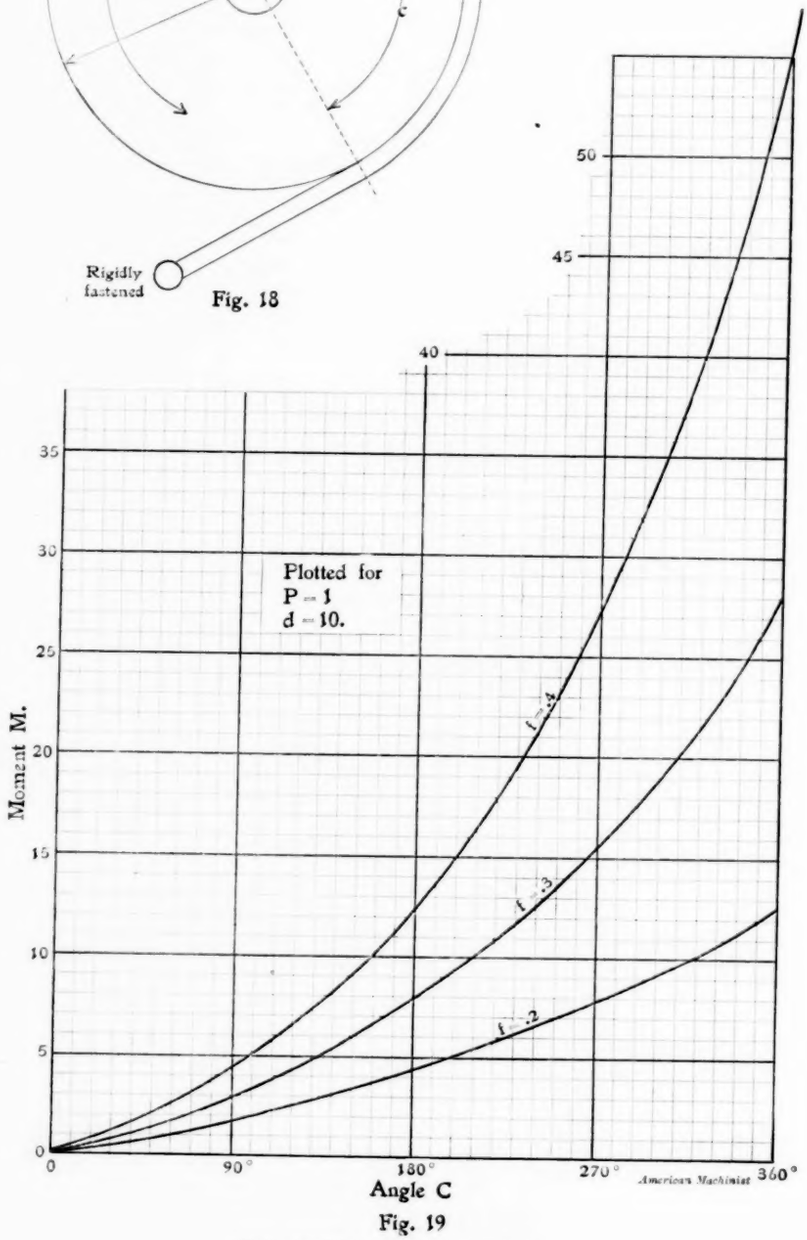


Fig. 19

THE ACTION OF THE BAND BRAKE.

Distance of center of gravity from vertex

$$= c = \frac{3}{4}\,\frac{h^4 - h'^4}{h^3 - h'^3}$$

$$r^2 = \frac{3}{80}\left(\frac{d^2}{h^2} + 16\right)\frac{h^5 - h'^5}{h^3 - h'^3} - \frac{9}{16}\left(\frac{h^4 - h'^4}{h^3 - h'^3}\right)^2$$

Fig. 16—Frustum of a wedge about an axis through its center of gravity, parallel to its base and perpendicular to its edge. Volume and center of gravity same as for Fig. 13.

$$r^2 = \frac{d^2}{12} + \frac{h^4 - h'^4}{2(h^2 - h'^2)} - \frac{4}{9}\left(\frac{h^3 - h'^3}{h^2 - h'^2}\right)^2$$

Fig. 17—Frustum of a pyramid about an axis through its center of gravity and parallel to a diagonal of its base. Volume =

$$\frac{a\,d}{h^2}\,\frac{h^3 - h'^3}{3}$$

Distance of center of gravity from vertex

$$= c = \frac{3}{4}\,\frac{h^4 - h'^4}{h^3 - h'^3}$$

$$r^2 = \frac{1}{40}\left(\frac{d^2}{h^2} + 24\right)\frac{h^5 - h'^5}{h^3 - h'^3} - \frac{9}{16}\left(\frac{h^4 - h'^4}{h^3 - h'^3}\right)^2$$

The square of the radius of gyration of a body about an axis through its center of gravity being known, as r^2, the square of its radius of gyration about any other axis parallel to the first, and distant x from it, will be:

$$r'^2 = r^2 + x^2 \qquad (5)$$

It was by this formula that the values of r^2 for Figs. 10, 11 and 12 were derived from those for Figs. 7, 8 and 9. It may be applied to any figure, and is usually the most convenient way of finding the square of the radius of gyration of an eccentrically disposed body. It is because of this that the values of r^2 for the figures shown have been given for rotation about axes through the centers of gravity.

Method of Procedure—To find the kinetic energy of any rotating body, separate it into elements which correspond to some of the elementary forms of Figs. 1 to 17. Thus a flywheel and shaft may be separated into: Rim, similar to Fig. 2; hub, similar to Fig. 2; arms, similar to Fig. 15; shaft, similar to Fig. 1. For each of these parts find weight (from volume) and r^2 *about the proper axis of rotation*, using the method of formula (5) when necessary, as for the arms. Substitute these values of w and r^2, with S, in (2), obtaining thus the kinetic energy of each element. The sum of these separate energies is the kinetic energy of the whole body.

Find this for the whole system of connected moving bodies by (1) and (2).

Live Load.—A live load, as a weight being raised or lowered, may be expressed as a torque at the brake drum. Thus, suppose the diameter of brake drum to be d inches and the effective force at its circumference due to live load to be L pounds. Then the torque so caused is $\frac{L\,d}{24}$ pound-feet. If the weight is being lifted when the brake is applied, this moment retards; if the weight is descending, this moment opposes retardation.

Friction.—The effect of bearing and other friction may be found experimentally and expressed either as the number of seconds T' required for the mechanism to come to rest under its own friction, or as the number of rotations N' made by the brake drum while so doing. If it be assumed that the coefficient of friction is independent of the speed, then

$$N' = \frac{S\,T'}{120} \qquad (6)$$

where S is the initial speed of brake drum in revolutions per minute. This can be only approximately correct.

Band Brake (Fig. 18).—The retarding moment of a band brake may be found as follows: Let

d = diameter of brake drum, inches;
P = force pulling free end of band, pounds;
c = angle of drum embraced by hand, degrees;
f = coefficient of friction between band and drum.

Values of f under different conditions are about as follows: Leather on metals, f equals about 0.4; leather on wood, f equals about 0.3; metals on wood, f equals about 0.3; metals on metals, f equals about 0.2.

Find K such that:

$$\text{Com. log. } K = 0.00758\,f\,c \qquad (7)$$

Then the retarding moment of such a band is:

$$M = P(K - 1)\,\frac{d}{2} \qquad (8)$$

This is directly proportional to the pull P and diameter of drum d, but increases very rapidly with the angle c or coefficient of friction f. This is illustrated by the curves of Fig. 19, which show the value of M for different values of the angle c and for the coefficient of friction f. In this diagram $P = 1$, and $d = 10$.

Echoes From the Oil Country.

TRUING A CRANK PIN IN THE WOODS.

"Say, Charlie, here is the man we made that valve stem for, day before yesterday. He says it is too long and strikes on the end of the steam chest; how did you come to do that?"

"I can't see how that can be, Mr. Osborne; I measured it up carefully and made the new one about 1-16 inch shorter, as near as I could get at it. I couldn't get an exact measurement because the break was kind of ragged, but I am sure it is not any longer. Here are my measures on a stick, where I put them before we welded the new piece on. I guess somebody don't know how to set a valve or something?"

"Well, I just set that valve myself," said the man who had come in with the complaint, "and there can't any of you fellows show me anything on it. I can give you pointers you never knew about valves. That stem is too long and has got to be fixed right off. I can't get that mill going any too quick."

To keep peace in the family I thought it best to go with him myself and see just what was the matter and who was to blame; so we took the train and were soon at the mill. There I found that my friend had never taken the steam chest off after setting the valve, but had jumped at the conclusion that because there was a knock of course it was the stem. As the valve stem did not project beyond the valve I at once saw it was not the stem that struck but the valve itself, as some light marks showed. He tried to argue that it was impossible, because when he pulled the engine around the valve cleared nicely.

As the engine had a circular saw on the end of the crank shaft, and was intended to run at least 450 revolutions to strain the saw up properly, and as its valve motion was transmitted through a rock shaft and everything was more or less loose, I could see lots of chance for a little more travel when under speed than when pulled by hand. I took up as much lost motion as I thought safe, and set the valve and started up to make sure things wouldn't spring enough to stick, as there was very little space on either end. Full speed showed the valve stem and valve O. K., but the crank pin made a clatter that would shame a threshing machine. The brasses were very loose and I tried keying them up, against his protest that they had to be left loose to run cool. They were hot in a few minutes and I began hunting the cause. He said it was the foundation, that the builders of the engine had been there and they said so. I had seen lots of worse foundations, and as it was some time before I could get a train I kept on hunting and found the crank pin out of square about 1-16 inch, or possibly 5-64 inch. It was a side-draft engine with a disk crank, and the pin had evidently never been true. I convinced him that it was out by disconnecting the rod from the crosshead, and, after keying it up tight enough on the crank pin to hold its own weight, pulling it around and measuring to the guides. That kind of a test magnified enough to make things look in pretty bad shape, and I told him it ought to be fixed as soon as possible, and that I could fix it where it was in about a day, including my time going to and from the shop, or, say, for $5 and my dinner and car fare.

As he was not the owner of the mill, he could not decide, so I left, but the next morning I got a message to come down and fix it as I had agreed. So I went down, armed with a square, three files, a half-round scraper, a sheet of emery cloth, a pair of calipers and a belt lacing.

Fortunately the disk was faced off flat, and looked true when trued with his sawyer's straight-edge; so I soon found where the pin was out the worst and filed a flat spot on one side, so that I made it square with the disk. This would of course give a streak that began at nothing where the pin was farthest from the square and gave quite a flat space at the other end. The other side of the pin was treated

in the same way, except that the big end of the streak stood the other way.

The center of the streak served to show how much to take off on the quarter on the first side, and the calipers were a guide to file the last side by. This gave a pin that stood square with the disk in four places and was a pretty tough looking thing when viewed as a bearing. My friend looked solemn and took occasion to remind me that I was to do the job so that it ran satisfactorily for $5. I began to think I had taken off a pretty large bite myself, but I was in for it. I rounded it up as well as I could, using the square and the calipers, and when I thought it pretty near round I put the brasses on in their strap and turned them round a few times with a piece of wood between them and the key to get a pressure and calipering from them to the disk to prove my squaring. This gave me some marks on the high places, which I eased off, and I filed the brasses in the center where they rubbed and tried again.

About an hour's work in this way and I had a reasonable bearing in spots on the pin, and the brasses touched nearly one half way around, and I connected up and started the engine. It ran cooler and quieter than it had the day before, and I began to feel good. After running a few minutes I disconnected and used the fine file on the pin and the scraper on the brasses. A few trials and I was ready for the emery cloth and the belt lacing. Wrapping a strip of emery cloth around the pin and taking hold of each end of the lacing, with it passed around the pin and enough more to bring it back to me, I soon had a polish on that pin that was elegant. Its reflection or something else seemed to cheer up my friend, and when I started up and ran full speed for half an hour without pound and he found the pin was still cool he was greatly pleased, and he declared he would have had a good man at the engine long before if the owner would have allowed him to.

Every time I saw him after that he would take time to tell me how nicely the engine ran, and how he wished it had been done long before. W. OSBORNE.

Working Drawings—Some Faults to Avoid.

The practice of making a single detail of a machine part and then calling for "one right-hand and one left-hand" has caused its share of trouble and led to the making of more than one expensive blunder. The draftsman knows at the time of making the drawing which he refers to as right-hand, but another person making out an order to replace a worn or broken part is very apt to view the machine from a different standpoint, and order just the piece which is not wanted. There is a picturesque indefiniteness about the terms right-hand and left-hand when used without connections which define their meaning, which it would be well to avoid in a line of work which aims at the utmost precision and exactness. It not infrequently happens that when the question is raised after a lapse of time the draftsman himself is uncertain as to which is which, when no longer supported by a recollection of his own intention in the matter. Generally speaking, this faulty form of expression causes no trouble in building the machine, but when a breakdown occurs and a rush order for a part to replace the broken one comes in, the uncertainty stares one in the face and delay occurs until an investigation can be made; or, worse still, the wrong casting is made and finished only to prove of no use and another period of waiting must ensue until a second one can be produced. This is no fancy sketch. I have known it to occur upon more than one occasion from this seemingly simple cause. It is, however, entirely unnecessary. By distinguishing each piece with a letter and marking them on the drawing *A*, as shown, *B* left-hand, the confusion cannot arise. It is also possible to continue this system and call for a great many variations from the detail by giving a separate letter for each change. For instance, a third casting may be called for same as *A* with exceptions noted and to be marked *C*, and so on down the alphabet. This is a practice that should be but sparingly indulged in, however.

Where details are designated by a letter, number, or any other mark, there should be no possibility of confusion arising as to its precise meaning; if a second detail is required, differing in even the slightest degree, it should be known by a different letter or mark. A drawing made by a draftsman of the careless variety called for 60 pairs of flanges marked *A*, and on another part of the sheet called for 20 male flanges of the same size *R*, and 35 female ones *W*. Here we have the same mark for two different articles, and also two different things under the same mark, which led to a lengthy argument between two men in the shop who each derived his information from the marks upon the castings as they came from the foundry, and, like the knights who fought about the shield which was different on each side, of course they were both right. The establishment which allows loose methods to obtain in the drawing room usually maintains a similar condition of affairs in the shops; and here also are to be found the men who will spend time hunting the foreman rather than reason out for themselves anything in the least obscure. In the same place will likely be found that other class of men who will not report a mistake when they see one: "It is not their business to make drawings; they are not paid for doing it."

Making drawings of assembled parts serve as detail sheets is a fruitful cause of annoyance, especially when carried to such an extreme as is sometimes done. There is difficulty in showing finish where required, and it is generally impossible to figure such drawings properly unless they are of a very simple character. Engineers often make drawings which merely show what they require without any effort to make the pathway easy for those who must work to them. They crowd many things on one sheet to a small scale, bury them in figures, make group drawings serve for detail, omit figures which are essential to the correct carrying out of their plans and in other ways render their meaning so obscure that parties executing the work often find it to their interest to make new drawings in a proper manner for their own use, a custom which is very frequently followed in bridge work and structural work generally, the bid in these instances being made upon little more than an outline of what is required. Sometimes this plan is not productive of the best results; the work being done for a lump sum, the details are made of the smallest and lightest sections which will meet the requirements, controlled only by the regard which the bidders have for their own reputation as engineers and business men. On the other hand, the practice now very much in vogue of bidding upon such work by the pound sometimes produces extreme results of the opposite character. That is, sections are used that are heavier than is required; the members are apt to be stronger than the joints connecting them to each other, or a shallow and heavy beam or strut is used where a deeper and lighter one would have been stiffer and better. Perhaps the most satisfactory solution of the problem is the price per pound bid, the drawings to be passed upon by a competent engineer in the interests of the purchaser.

Drawings prepared for the purpose of securing bids upon work to be done are occasionally made to a small scale with the deliberate intention of creating an impression of smallness upon the minds of bidders, and so influencing the price in accordance with the apparently less important character of the details so represented. This somewhat questionable reason for deciding to use a small scale is defended upon the score of its being the bidder's province to fully inform himself as to the character of the work which he proposes furnishing, and that it is no part of the purchaser's duty to do more than clearly indicate his requirements when asking for the price for which they will be met. Be this as it may, the practice will probably be continued by those who believe in it, whether the effect of it is worth considering or not. It is safe to say that experienced bidders will not be greatly influenced by it, while the law of the survival of the fittest will deal rather harshly with those who make propositions without the necessary knowledge and experience back of them.

A frequent cause of complaint from those who have the checking of drawings, over the making of which they have had

no control, is the number of unnecessary and worse than useless figures that appear upon so many of them. For instance, figures upon a general drawing which refer to detail measurements of minor importance, or perhaps of no importance whatever, which concern the patternmaker or machinist but have no relation to the general construction of the work. They must be verified for all that before the drawing can be endorsed as correct, lest by some chance they become productive of error. The ideal drawing has all the figures upon it which help to further the purpose for which it was made, and none other.

GERALD E. FLANAGAN.

Machine-Tool Business as Carried on To-Day.

According to a statement in the "Leeds Mercury," one of the leading engineering firms in Leeds received a letter some days ago from a German firm, soliciting orders for American machine tools for "a very low figure, which would not nearly cover the price at which they were bought." The writer stated that he had taken over from a well-known firm of Berlin machine-tool makers—whose name need not be specified—their entire stock of first-class American machine tools. These included lathes, planing, drilling, and other descriptions of machine tools, which might be had for an old song, the firm in question having started up their new works, and now wanting their storerooms for their own products." All the machines were first-class American tools and absolutely new. The latest stock list of the Berlin firm was enclosed with a column for the revised price list left blank! The Leeds firm addressed was requested to select what machines it might require, and to inform the writer of their choice, to enable him to submit specifications and prices without delay. Needless to say, adds the "Mercury," the Leeds firm, which not only makes all its own machine tools, but exports machine tools to every quarter of the globe, were moved to pity, but not to business.—"Iron & Coal Trades Review," London.

Though fairly familiar with the machine-tool situation in Berlin, we are at a loss to understand the meaning of this report, and we very much doubt its accuracy. We know of no Berlin machine-tool builder that has been selling American machine tools and has a warehouse stocked with first-class machines made here, and the report seems decidedly fishy.

A Suggestion for the Machine Shop.

Next to the mill, the miller's most important study is the mill-owner. In truth, we are not sure but that these two subjects are about on a par; we do not know but that it is quite as necessary to be able to get around your employer as it is to understand about getting around his mill. We mean "get around" in the honorable sense of dealing pleasantly and successfully with him for the good of the mill, as, for instance, in inducing him to make a needed purchase or securing his approval of a desirable alteration. Happy the miller whose employer is easy of approach and quick to appreciate suggestions of improvement. Where, however, the employer is difficult, unappreciative, perhaps even constitutionally suspicious, what's to be done? Throw up the job? Or stay and let the mill go to the dogs? Or set your teeth, sharpen your wits, study your man till you find how to approach him successfully, and win out on that line? Your decision will depend on the stuff you are made of.—"The Roller Mill."

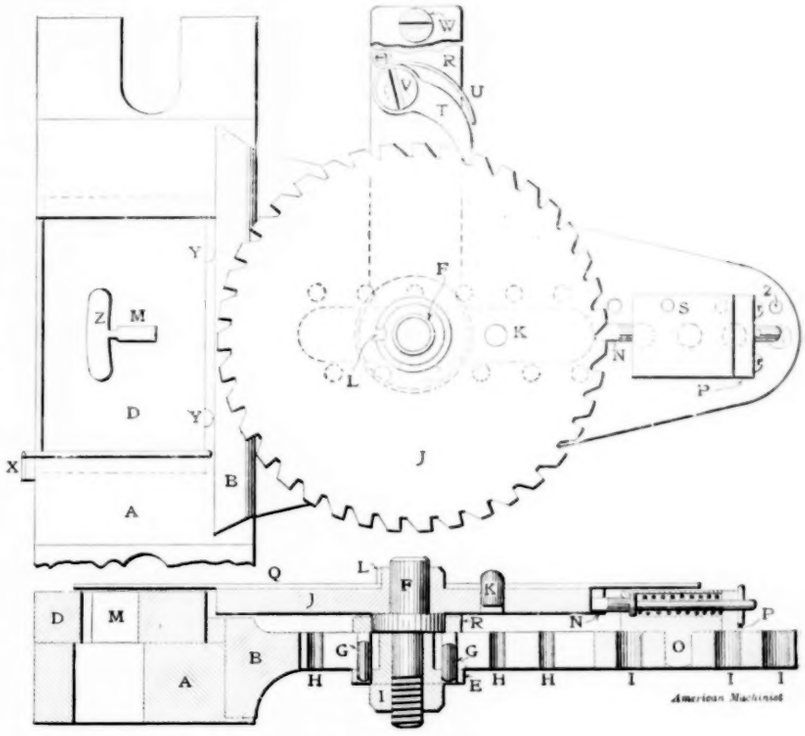


FIG. I. THE DIE AND INDEXING DEVICE.

An Improved Dial Feed Armature Disk Die.

BY JOSEPH V. WOODWORTH.

The die and attachments here shown, for notching armature disks, require little attendance while in operation and can be used for punching a number of different sizes of disks. It can be used in any single-acting power press to which a connecting rod for operating the feed can be connected. The sheet-iron blanks used for the disks are irregular in shape, and it is necessary to finish them to the correct radius while punching the slots. The die *D* is made first. The best way to finish the templet is to solder it to the face-plate of the lathe, when it can be turned to the exact radius both outside and inside. Then the die is worked out and finished to it at *M* and *Z*, as shown, taking care to have it central in the die. The bolster *A* is of the regular type, only heavier. It is dovetailed crosswise for the die and left large enough for the key *X* also. It is then dovetailed on the side or front for the extension plate *B*. This should be a casting, strong and heavy and perfectly rigid. It is to drive tightly into *B*, and a set-screw is let into each side afterwards to permanently locate it. We are now ready to lay out the slot *C* and the holes *H* by first striking a line from the center of the die *M* the entire length of the plate. The centers for the twelve holes *H* and for the ends of slot *C* are then located, and *C* is then worked out to the same width for its entire length. The distances between the holes *H* are one-half the differences in the diameters of the disks to be punched.

The bushing *E* and the stud *F* are both of tool steel, the bushing being made first and turned to fit nicely the slot *C* and left with a wide shoulder at *E*, the top coming a trifle below the face of the plate *B*. A reamed hole through the center admits the stud *F*, with the nut *I* on one end and the other just fitting the hole in the index plate J. Drilling the holes in the bushings for the dowel-pins *G G* required to be done accurately, as the finished radius of the disk depended on their location. The method used for gaging it correctly is of interest. A piece of cast iron, about 1 inch wide and in length about ¾ inch longer than half the diameter of the smallest armature blank, with a lug at one end projecting from the face, was strapped on the face-plate with one end central. A hole was let into this end and reamed to the same size as stud *F*. The inside of the lug at the other end was then turned to exactly the same radius as the die *D* at *Z*, which was that of the next to the smallest

disk. The outside of the lug was then turned to a radius sufficiently small to allow it to enter the die freely This gage or templet was then removed from the lathe and the end with the hole was set on over the stud *F*. The nut *I* was loosened, and the stud and bushing were moved forward until the other end of the gage just entered the die *Z*, and the turned face on the lug rested snugly against the side *Z*. The nut *T* was then tightened and the holes for the dowels *G G* were transferred through the plate *B* to the bushing *E*, and the dowel-pins were then made and driven in. This means for locating the holes is similar to the button method used for locating holes in drill jigs, and is just as reliable and accurate.

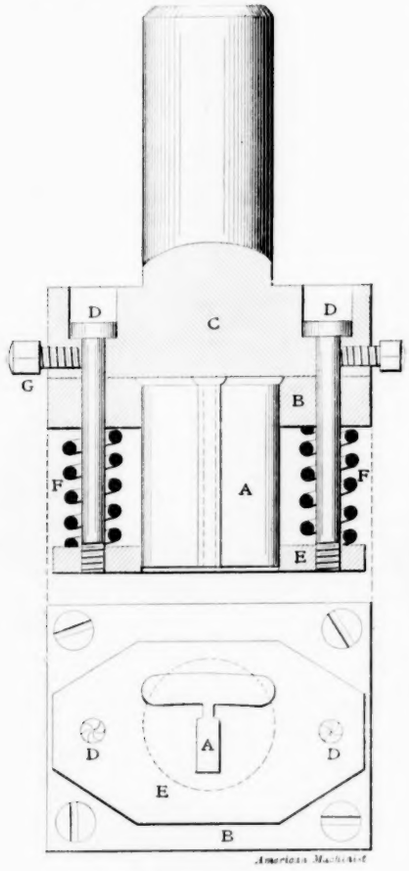


FIG. 2. THE PUNCH.

The index plate *J* was of cast iron, with a hub on one side, the same size as the hole in the armature disk blank. A keyway in the hub allows of the small key punched in the disk to enter and locate. As most disks have from three to five holes in them to lighten them, one of them is utilized to secure the blank and carry it with the index plate, the dowel-pin *K* fitting the hole snugly. The index plate rests on the collar of the stud *F*. The two pins *Y Y* are positive stops for the die *D*. The ratchet lever *R* fits the collar of the stud *F* and rests between the face of the extension plate *B* and the index plate *J*, with the ratchet pawl *T* and a flat spring to keep it against the index plate *J*. The screw *W* is for fastening the link by which it is connected to the adjustable feed rod on the side of the press.

The positive stop for the index plate is located at the end of the extension plate. A projecting pin fits the holes 1 in the extension plate, and a dowel-pin *S* entering the holes 2 locates it permanently.

The punch is shown in Fig. 2. The punch A is finished to size in the usual way, by shearing it through the die, and is fastened within the machine-steel pad *B*, which in turn is fastened to the cast-iron holder *C*. The two flat-head studs *D D* are let down through the holder and pad, as shown, and are screwed into the stripper or spring pad *E*. The two springs *F F* hold the pad at the face of the punch with sufficient tension to strip the metal from it after punching and to hold the blank firmly to the face of the die. The two set-screws G G facilitate the grinding of the pinion when dull, allowing it to be done without removing the pad, all that is necessary being to compress it and tighten the screws against the studs. This allows the face of the punch to project out of the stripper and makes the grinding easy.

When in operation, the punch and die are set up in the press, and a blank *Q*, ready to be notched, is placed on the index plate *J*, the pin *K* entering one of the holes. The feed is then adjusted and the press is kept running continually until the entire disk is finished. When the punch is descending, the blank is held securely between the pad *E* and the die. The notch is then punched and the outer ends are trimmed to the correct radius. As the punch rises, the metal is stripped and the index plate is revolved one space, leaving the blank in position for the punching of the next notch.

To change the die for another size, the bushing *E* is moved forward or backward and the dowel-pins *G G* are entered into another pair of holes. Another die, finished to the proper radius, replaces the one shown, and, if necessary, a different index plate is substituted.

Letters from Practical Men

Cutting Square Threaded Screws.

Editor American Machinist:

A great number of machinists have never cut square threads above 1-inch pitch, and so were never "up against it," as Mr. A. L. De Leeuw and the machinist he mentioned in his article on page 1160 were.

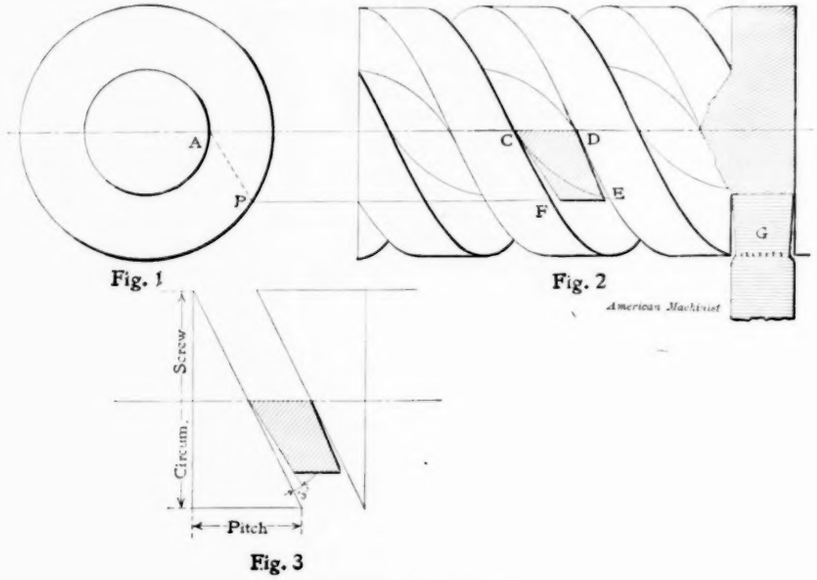
In answer to "H.," on page 1217, I will give what information I can on cutting square threads, and show by the accompanying sketches how to get the bevel and clearance for a tool to cut square threads that will be square.

Mr. De Leeuw says the dotted tool shown in his Fig. 1 will not stand up to the work. No, it will not, as it is too sharp on the left-hand side, where it is beveled to the angle of the small circumference or bottom of the thread.

If the tool is relieved from *A* to *B*, as in Fig. 1, it will not follow the angle of the bottom of the thread except on the cutting edge, and that will allow the tool to have less angle on the side, and consequently it will be stronger on the line of greatest stress.

Fig. 3 shows how to get the angle and clearance of a tool for any pitch. Take the circumference for the altitude of the triangle and the pitch for the base when the hypothenuse gives the angle of the thread. Allow 5 degrees for clearance; set a bevel protractor to this angle and you can grind a tool and have it right. It is very important to get the angle right; for on a screw of small diameter and large pitch, if the tool has too much clearance, it will not stand up, as it is not backed up properly.

Use a tool like *C F D E*, Fig. 2, for



CUTTING SQUARE THREADS.

roughing out, and take right and left side cutting tools to finish. *G* shows how the tool should be finished on top, in which view it is simply backed off like a cut-off tool. I have used these tools on tough steel screws about the size and pitch mentioned by Mr. De Leeuw, and if his machinist will make his tools like the above he will have a square thread and the nut will fit. C. McLAUGHLIN.

[Of course the line *A B* need not be carried right up to the point *A*. The end of the tool would naturally be so ground as to give the proper clearance angle, but this end would be so short as to avoid interference.—Ed.]

The Steel T-Square vs. the Parallel Straight-Edge.

Editor American Machinist:

In the "American Machinist," page 1192, A. P. asks of the advisability of purchasing a steel T-square. I know of but one redeeming feature of the steel T-square—it will last a lifetime—while, on the other hand, it is almost impossible to keep it from rusting in the summer time, and it is heavy and consequently not easily manipulated.

If anyone *will* use a T-square, I think a celluloid lined blade with an adjustable head, as described in Soltmann's catalog, page 139, No. 5888, is by all means the best. Such a square is light, capable of minute adjustment and, with reasonable care, durable. A T-square blade is most liable to be injured by striking the heads of thumb tacks. This will not injure the celluloid edge in the least. The experiment can be easily tried on the inside edge of a celluloid triangle by putting a tack in the table and letting the head project, say, 1-32 inch.

But why use a T-square at all? To my mind a parallel sliding straight-edge is as far ahead of a T-square as the machine tools of to-day are in advance of those of twenty years ago. With this arrangement there is no need of keeping the edge of the drawing board square; the blade slides easily from either end without the necessity of always keeping the left hand on the head of the square; work is done as easily and accurately at the right-hand end of the board as at the left, which is almost impossible with the ordinary T-square, especially if it is of any length.

Several varieties of these have been described in the "American Machinist." They may also be purchased at almost any price from $1.50 to $10. I am using one which cost, besides the blade, only $1.50, and which, with a few additions made by myself, is all that could be desired. It originally consisted of six small sheaves, about 1½ inches in diameter; a coil of wire and two clamps, one for each end of the blade, as shown in Fig. 1. One of these clamps was discarded and in its place an adjustable clamp was used, as shown in Figs. 2 and 3, in which *A* is the blade, and *B* the board. *C* is a spindle threaded at each end for the knurled thumb nuts *D*, which turn freely in casting *E*. Casting *F* is soldered to the spindle and has a small hole *G* to receive wire *H*, which is held in place by screw *J*. *F* should be a good sliding fit on bottom of *E*. *E* has a hub *K* which should fit a corresponding hole in the blade. A small screw is soldered into hub and serves to hold the casting *E* to the blade by means of a washer *L* and thumb nut at *M*. It is clear that by turning the thumb nuts *D* the blade may be moved along on the wire, one nut serving as a check on the other. This makes it possible to tack a drawing down with but little attention to lining it up, after which the blade is adjusted to it.

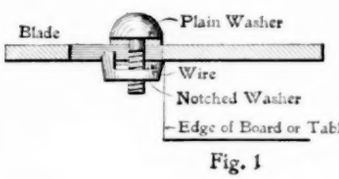


Fig. 1

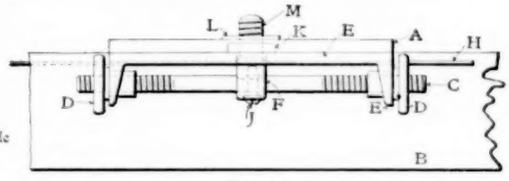


Fig. 2

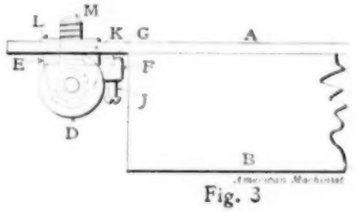


Fig. 3

FIXED CLAMP FOR ONE END OF BLADE. ADJUSTABLE CLAMP FOR THE OTHER END OF BLADE.

The wires were originally intended to be fastened together under the board with a piece of strong twine, but a small turnbuckle is much better, as just the right tension may be more readily obtained.

I doubt if anyone who has ever used a parallel straight-edge would try to do without it afterwards, and one who has never used one would be surprised at its accuracy combined with its easy manipulation. FRED S. ENGLISH.

Manual Training at Cornell University.

Editor American Machinist:

I read with interest the article by Beauchamp on page 1111, which discusses "Teachers for Manual Training Schools."

It seems to me that if the methods of some of our best technical schools were more thoroughly investigated by the writer he would probably change his opinions.

A man receiving the degree of M. E. at Cornell has had the experience of which the writer speaks by saying that during his four years he gets 1,200 hours of shop practice. This practice starts with joining and goes on to turning and pattern making. When through with pattern-making the student takes his patterns into the foundry and casts them, beginning with simple things and gradually learning to set up and cast the more difficult pieces. After his foundry practice he goes into the blacksmith shop and after many hours of hard work he begins and makes a set of tools with which he finishes up the castings that he made in the foundry.

During the four years in which he is getting this practical knowledge, he has gotten the theoretical knowledge of mechanics, etc. Besides this, he has had his engine tests, tests on the strength of materials, the hours spent on mechanical drawing, machine design, etc., including lectures on these subjects by leading professors.

The man who is really studying engineering will not be found at the seashore during his fourteen weeks' vacation. Look around in our locomotive shops and similar places and you will find him hard at work getting a solid foundation for the work of his chosen profession.

If the writer will investigate these things he will find that shopwork is not "above" the college man, but that to get a good start he is willing to commence at the bottom, by sweeping out the floor and as he shows that he is competent to do this he wants to be given a chance at the next step higher. A. A. G.

Correspondence School Instruction in Drafting.

Editor American Machinist:

There is scarcely a week in which I do not receive one or more cramped, ill-written, badly-spelled letters, bearing in every line the marks of illiteracy. The writers have spent a good many dollars on some correspondence course in drafting or engineering and have been positively assured (guaranteed is the word they use) that this course if followed out will make competent draftsmen of them. They have spent their evenings for many months in laboriously making plates which to a large extent are simply copies to scale of sketches fully dimensioned in every particular, and not requiring the slightest mechanical conception for their execution. It is not strange that they believe they have been successful, for 98 per cent. seems to be about the lowest marking any of them receive. These men, as I say, have been guaranteed to be made into draftsmen and yet they are no more draftsmen than if they had spent three or four days learning to trace and had then traced a half dozen shop drawings at home. From an experience that would

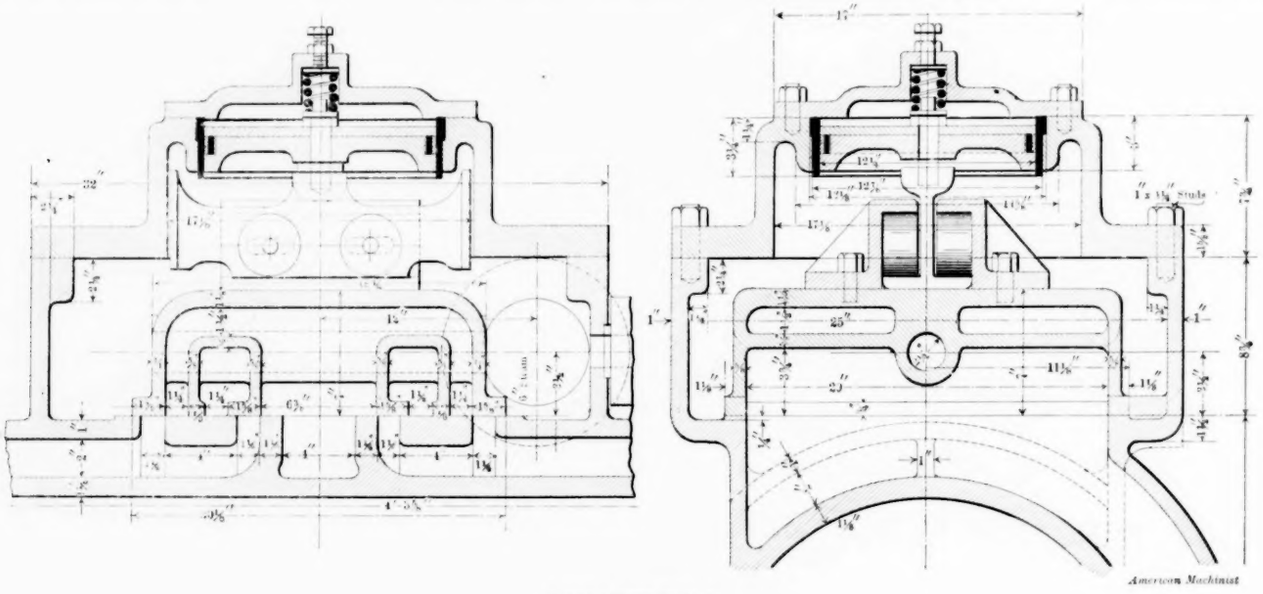
average nearly one correspondence school application a day, we would estimate the money value at the start of a man educated either way at about the same figure. The above of course assumes that the two men possess the same general education. My criticism is not of the educational features of the schools, but of the claim that they can make a draftsman of anyone who will go through their course. In view of past experience with these men we rarely hire them now, even as beginners, unless they have had some practical experience bearing on the work outside of their course. We find that the best of them have little or no conception of projection, and yet this lies at the very foundation of drafting. In fact, considering that the whole subject covers work in three dimensions and that the most elementary drafting requires clear space conceptions, it is hard to see how proper instruction can be transmitted by mail to the sort of men who are induced to take these courses.

The average correspondence school man's idea of drafting is like that of a woman who taught drawing and who brought her class to our drawing room to see work similar to theirs practically carried on. They were taken to the boards and shown the work in progress, but a worried look came over the good lady's face, and, turning to her guide, she asked: "But where are the things these men are drawing?" "What do you mean?" was asked. "Why, the copies, the models that they are making their drawings from." Tapping the nearest draftsman's forehead, he replied "In there." We know of nothing except practical experience or personal explanation by a competent instructor, with tangible bodies as illustrations, that will put these conceptions "in there."

The writer does not want to be understood as condemning correspondence schools in general. Such text books of the schools as I have seen appear to be excellent for their purpose, and I would be glad to own some of them myself; but it is hard to realize what benefit other than the prodding effect comes from their method of instruction. It is doubtless true that to many persons this pushing is valuable, although there may be some question as to whether a man who has not sufficient energy to keep himself to his work in improving his education will have sufficient energy to attain any great advancement, once the education is secured.*

The writer has known of several men who have taken correspondence school courses and have afterward largely improved their positions in life and who have given much of the credit therefor to the schools. They have, however, invariably been men with much practical experience, who got from the correspondence schools the "book learning" which they lacked. Under similar conditions I have myself recommended these schools to enquirers; but that they can make a draftsman of a man, I have not yet seen demonstrated. I have my doubts about their chance of success on other practical subjects which some of them undertake to teach, but as my personal experience with their graduates is confined to drafting I will limit my criticisms to this subject. X. Y. Z.

*The disconnected nature of private study leaves many important gaps in the student's chain of work. The great feature of any organized course of instruction is that it has no such gaps, and this the correspondence courses share with others. It is in the direction of the student's work and in making it like a continuous flight of steps that the chief value of a teacher lies.—Ed.



A BALANCED VALVE.

The Area of Balance Piston for Slide Valves.

Editor American Machinist:

Enclosed you will find blueprints showing a longitudinal and transverse section of a balanced valve designed for a 24x40-inch double-cylindered engine for slope haulage. The valve is double ported in order to obtain sufficient port areas for the high speed of about 125 revolutions per minute without an excessive amount of back pressure, say not to exceed 2 pounds. The engine being reversible makes it necessary to have the valve balanced as nearly as possible.

In designing this valve, I obtained the diameter of the balance piston, by applying a handy rule which was used in determining the diameter of the balance pistons of a series of engines ranging in sizes from 14x24 to 30x48 inches. The style of the valves used on this line of engines was the ordinary "D" single-ported slide valves balanced with the same device as shown on the accompanying blueprints. The steam and exhaust ports in these engine cylinders ranged respectively from 7/8x12 and 1¾x12 to 1¼x26 and 2¼x26 inches, while the sizes of the valves varied respectively from 5¾x14 to 7½x28¾ inches.

The rule referred to above is that the area of the balanced piston for any slide valve is based solely upon the size of steam and exhaust ports, being 85 per cent. of the combined areas of one steam and one exhaust port, regardless of everything else.

This proportion has resulted in practice in giving easy working balanced valves, as shown by the ease with which all of the above engines may be reversed. This rule applied to the double-ported valve would give a result as follows: 1¼ + 1¼ + 4 × 20 = 130 inches; 91 per cent. of 130 equals 117 area of piston, or about 12¼ inches diameter, which would appear to me rather small for a valve of these dimensions, 20⅛ wide by 22¼ inches long.

As to the origin of this rule, or what it is based upon, I cannot say. I found it

among a lot of data of an old engine concern who have been designing on these lines, but I would rather consider it as straining it past the limit of elasticity to apply it to this particular valve owing to its area.

Will you or any of your readers kindly give me some light on this subject, stating whether this rule will apply to the double-ported valve, giving a reversing valve gear which would be controllable?

THOS. L. BRYCE.

[One of the early volumes of the "Transactions of the American Society of Mechanical Engineers" contains a record of some experiments by Professor S. W. Robinson which throw light on the principles of the problem, though we do not know that they have ever been reduced to simple working rules. These experiments showed that the pressure upon the back of a valve was in a measure relieved by a creeping film of steam in the joint which, starting at the outer edge of the valve at steam-chest pressure, gradually fell until at the inner edge it had only the exhaust pressure. They also showed that a rational rule for a balancing piston must take into account both the areas exposed to the back pressure and to the steam pressure. The steam ports being filled alternately with steam at both pressures and not having a constant relation to the valve face, act as a disturbing element, and with a double-ported valve doubly so. If our readers can give any definite information on the subject we shall be glad to publish it.—Ed.]

A New Pillow Block.

Editor American Machinist:

We have designed a pillow block that we believe has not been used before, and as it promises some advantages over that ordinarily used, I hope it will interest some of your readers.

The accompanying drawings show a 3¼-inch pillow block of our new design. As will be seen from the drawings, the dead-eye block is bored conical to receive a conical shell lining, which may be made of either brass or babbitt, the latter being more commonly used for the purpose for which the pillow block was designed. Fig. 3 shows one of these babbitt linings which is made in a special mold and turned and bored to suit the dead-eye block. A number of these linings are kept on hand, and when one in use gives out it is removed by taking off the collar shown in Fig. 2 and a new lining is slipped in.

Of course, this bearing cannot be used where it is necessary to adjust the bearing for wear; but for rough work where dust and dirt cannot be done away with it gives excellent service, costs much less than the bearings ordinarily used for such purposes and can be relined without shutting down the machine more than a few minutes.

R. M. ENGINEER.

T-Squares—Machine Shop Drawings.

Editor American Machinist:

I have been expecting that someone would give your correspondent the same advice about T-squares that "Punch" gave to those about to get married: "Don't." I have used wooden and steel T-squares, but I won't any more when I can get a parallel rule attachment. I have had all our drafting boards equipped with the parallel rule attachments sold by Mr. Wm. Pilton and described in your columns. The straight-edges we use with them are 48 inches long and have celluloid edges. Even with the strings quite loose they are surprisingly accurate. One can push the straight-edge forward by taking hold of one end, then draw a line 36 inches long, back the straight-edge off and push it up to the line by the other end without being able to see any appreciable difference. The straight-edge stays where it is put without clamping and leaves one's hands free. Besides, one can easily set it parallel with a center line, or set it at a small angle for drawing threads, etc.

As we make some separate drawings for machine-shop use only, I will give some reasons for doing so. The original drawings of machines are often most conveniently and quickly drawn as partially assembled views, as a steam cylinder with heads, piston, steam-chest cover glands, lagging (we use cast-iron lagging) and sometimes valves. This drawing is made all complete on a large sheet, and from it the patterns are made. It is evident, however, that three-quarters of the dimensions and some entire views showing shapes of cores, etc., are not required on a machine-shop drawing, and it further appears that to show so many parts assembled is a little confusing, and may be inconvenient. For these reasons it saves much time in the machine-shop to make separate drawings of these details, with only the dimensions required for machining and assembling. These drawings are small in size, quickly made, and very convenient in the shop. We note on the complete large drawing any permanent changes we may make, giving the date and the machine for which the change was first made. The shop drawings may then be corrected freely, without confusing them with any notes made for record purposes only.

H. V. HAIGHT.

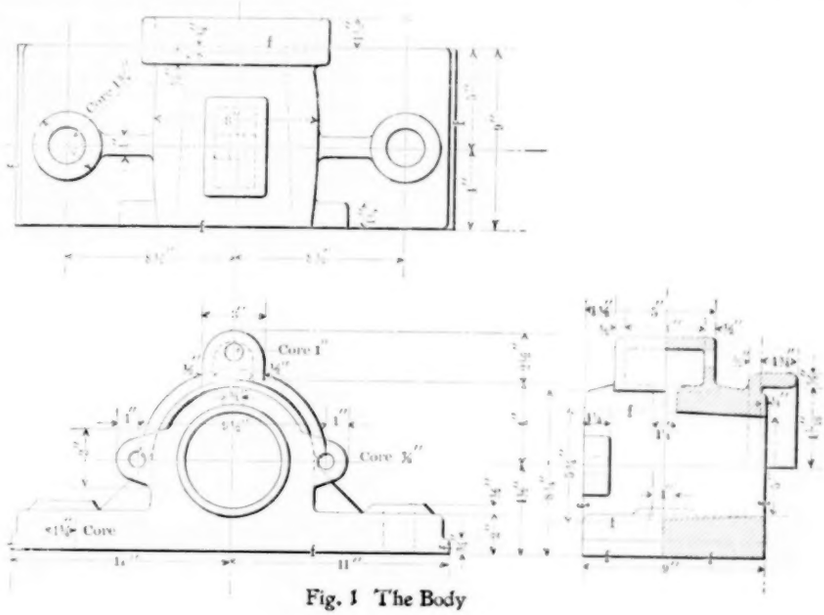


Fig. 1 The Body

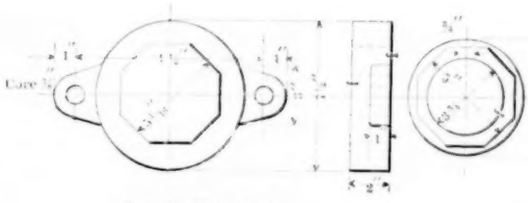


Fig. 2 The Collar

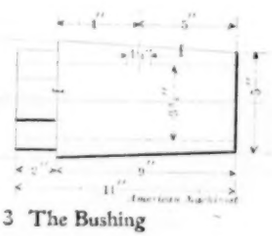


Fig. 3 The Bushing

DESIGN FOR A SMALL PILLOW BLOCK.

A Blueprinting Scheme.

Editor American Machinist:

To make good blueprints, being guided only by the appearance of exposed edge of sensitized paper, requires considerable experience, as all know who have had much printing to do on cloudy as well as clear days, and with various grades of pa-

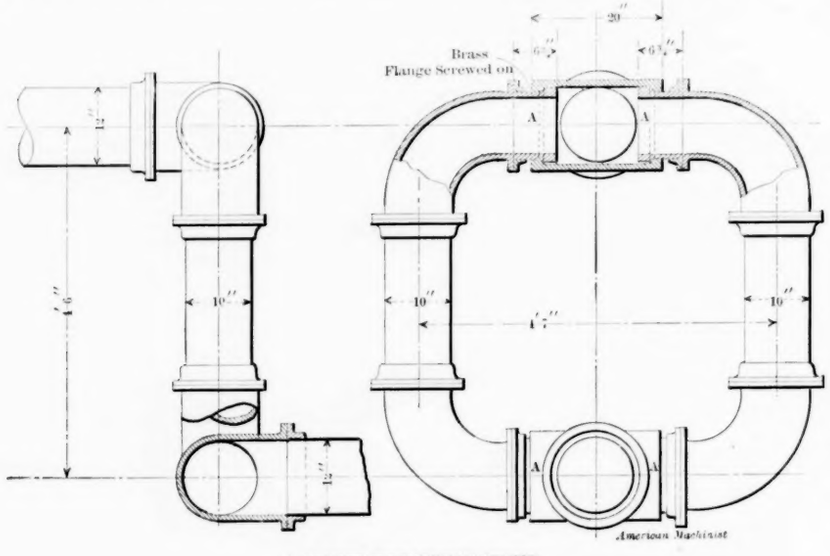
per. Very often, especially on a cloudy day, the edge looks just about right, but when taken out of the frame and given a ducking, it is only to find to our surprise that the print looks pale (scared to death) because it should have been allowed to remain in its glory for a longer period. We simply take a small piece of the same paper (say, about 4 inches square) and a piece of tracing cloth with several lines on its surface and lay these small pieces out at the same time the real print is being exposed and cover these samples with a piece of glass about 4 inches square. As a general rule, we can find a place on top of the frame for the "testing piece," and by having a small dish of water at hand for testing the print by tearing off a small bit and washing same to note its appearance, the novice can get just as good results as the experienced hand without danger of failures. ROBT. A. LACHMANN.

A Swivel Expansion Joint.

Editor American Machinist:

After reading the description of the expansion joints published in recent issues of the "American Machinist," I thought some of your readers might be interested in a joint we believe to be quite different from anything ever used before.

The idea was conceived about two years ago by one of our draftsmen and was immediately installed in our steam plant and has been in service ever since. The accompanying sketch shows the joint connected with the steam lines which were purposely put one 4 feet 6 inches above the other so as to suit the joint and allow it to hang vertically.



A SWIVEL EXPANSION JOINT.

There is no packing, but the seats were ground, and as the steam pressure forces the parts of the swivel tight together the steam cannot escape.

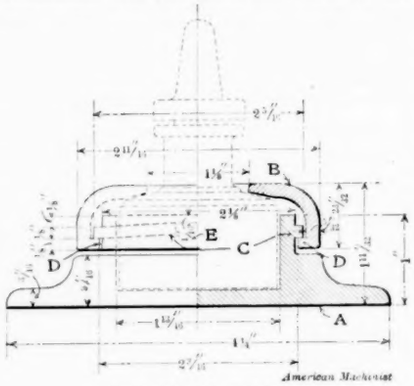
This joint takes but little horizontal space, and, as nearly all of it can be made of standard fittings, it can be built as cheaply as any joint I know of.

G. J. HOOKLAND.

A Handy Ink Bottle Holder.

Editor American Machinist:

The enclosed sketch shows a very handy and cheap holder for an ink bottle. Every draftsman will recognize the value of the same, for he knows what it means when he upsets his ink bottle.



INK BOTTLE HOLDER.

The holder consists of a circular base *A* and cap *B*, both of which are made of cast iron. The ink bottle sets into the base on the neck of which is a ridge *C* which has a slight downward slant. Two lugs *D*, about ⅜ of an inch wide, pass through the slots *E* and engage the ridge *C*. The cap is placed over the bottle and by giving it a slight twist it is clamped down firmly by means of the lugs *D* and the cam ridge *C*. This will hold the bottle firmly in place and the base is large enough so that it will take more than an ordinary knock to upset it.

This holder would be especially convenient in drawing schools, where so many students are handling the ink bottles that they are frequently upset.

H. D. VAN DOORN.

Standards in the Drafting Room.

Editor American Machinist:

In the matter of standards and data for the drafting room, much has been said and still there are many things which may be improved upon.

"G. J.," on page 1216, states that he thinks it good policy to give the engineering corps a list of standards in vogue in the shop. My experience has been that most drafting rooms are so equipped, some of course better and more completely than others. In the way of a list of patterns I think nothing more simple than a good card index, which is much more apt to be kept up to date than an information sheet.

The draftsman should not only be informed as to sizes of pattern lumber but also of the size of surfaced timber and lumber. For instance, one may order a 16x16-inch surfaced timber and he will most likely get 15½x15½-inch, which would cause you untold trouble in some cases if it were not allowed for. Only recently a large barrel elevator was erected at our works, and, all timbers being dressed, consequently the bolts came out about one inch longer than necessary and were cut off. There was also some trouble in getting the centers of head and foot shaft from the same cause, all of which might have been avoided had the designer figured on dressed timber.

It is also a good plan to have a list of special taps and dies, for there are often cases of special holes to be tapped in which it matters not if the threads are 11½ or 8 per inch.

"G. J." is correct when he urges that every firm should have a library and indexed list of catalogs. I do not think it necessary to have a special list of standard pipe taps and bolts, for they are to be found in all of our hand books. It does, however, save much worry and time if the draftsmen have a list of tap drills. The tap drill size ought to be put on the drawing.

In a shop that has much riveting to be done there should be a set of standard sheets of riveted joints—single, double and triple—giving all the necessary data of strains in plate and efficiency of joint, and so save much calculating for the different jobs as they arise.

If steel stacks are built there should be a list of standard joints and plates for all diameters and hights, also size and number of guy ropes with the strains on same at a given wind pressure. If the stacks are to be self-supporting standard bases, foundations and bolts should be furnished, although foundations must of course suit conditions.

I have found it good practice to figure on 17 fire bricks and 18 common bricks to the cubic foot and 125 pounds per cubic foot for common and 150 for fire bricks.

The success of a drafting room depends upon three things: First, the head drafts-

man, who can make or break the concern; second, the men in it; third, the system that enables the maximum amount of work to be gotten out with the least amount of time and labor. C. W. E. CLARKE.

A Little Information About the Granite Columns.

Editor American Machinist:

I have noted from time to time in your columns various suggestions as to how to turn the cathedral columns, which, according to a newspaper tale, broke in turning, they being carried by the ends and without any central support.

I am wondering if any of these suggestors know how to make a tool which will cut chips 2 inches thick and the shape of a segment of 10 or 20 degrees from a granite column; but this is what lathes have been doing off and on for eighteen years.

A half century ago was the beginning of the Hoosick Tunnel, and black powder and hand drills were slow and inefficient means for piercing the Green Mountains, so somebody devised a cutter head 25 feet diameter, armed at the rim with these same tools. The machine, like everything else in those days, was made up of timber; but the chief difficulty was that in boring the Green Mountains from the east side, the White Mountains are not near enough to shore up against. In spite of these troubles, those persevering people went 10 feet into a perpendicular wall of mica-slate, and the result may still be seen—or could be thirty years ago—a little to the south of the present entrance.

Some eighteen years ago I designed two granite column lathes for E. R. Cheney, of Boston; one 2x20 feet, the other 4x40 feet. The latest lathe, for columns 6x60 feet, is the work of Harry Spiller, of Boston, and is altogether a fine specimen of heavy design, especially, as I saw it in a photograph to-day, taking a 2-inch cut at front and back, and the 60-foot column supported by the ends alone.

Cheney will *turn* his columns precisely as he has done, but when it comes to *polishing* he will see to it that there is no 14 tons extra weight loaded on to hold down the grinding blocks. The column was broken when *polishing*—not *turning*—and the cause was the 14 tons unnecessary weight loaded on.

WILLIAM H. HARRISON.

Braintree, Mass.

Tube Forming Dies.

Editor American Machinist:

My communication on page 1214 seems to have caused Mr. B. J. Dougherty some surprise that I should dissent from his views upon methods of tube forming (page 1133), and he comments (page 1316) and explains what he should have said in his original communication. I probably should not write more upon the subject if he had not assumed to pass judgment upon the patent granted me, and to decide that I was not entitled to such a patent. He says "I have known this method over twenty two years." Well, the patent is over thirty years old and has long since expired. Tubes have been made in quantities that were half inch or more in diameter tapering down to less than one-tenth of an inch at the small end, and from IC tin, too. The fact that my patent upon the process made it possible to make such tubes in a perfect manner without a mandrel cannot be disproved by asserting that anyone knew of it ten years after the patent was granted, and as patents are not often granted upon devices which are "as old as the everlasting hills" I will at present rest upon the fact that the Patent Office found it to be new.

The truth is that Mr. Dougherty has overlooked the fact that when a metal blank is bent, as in tube forming, *compression* and *extension* are both acting in the same direction to hold the edges of the metal out against the die which is compressing the blank. A mandrel cannot then do any good, because the metal is moving away from it if it moves at all. And after the edges of the blank come together, the outward pressure becomes very great and holds the metal against the die powerfully. The edges of the blank must be cut true and must be free from fins of course, and when this is so there is no such thing as the edges slipping past each other. I did not state how thick or how thin the metal must be, nor how much taper was possible, for the good reason that, within certain limits, there are no controlling conditions. As I stated in my former communciation, I have made these tubes of widely varying dimensions, thickness and taper, and I have yet to see a tube made from a punched blank by any other process that could not be made much cheaper, and usually better, by this. A mandrel costs money to make and keep up, to say nothing of the mechanism for operating it, and it often greatly reduces the possible speed of machine and rate of production. MOSES G. WILDER.

Philadelphia.

Mounting Blueprints.

Editor American Machinist:

If the subject of blueprint mounting has not already reached the stage where another description of how to do it would be superfluous, I would like to describe the method which I have used for the last three years and found very satisfactory.

The material used is strawboard, about ⅛ inch in thickness and some good, strong, light manila paper. The boards are cut ½ inch larger all around than the outside dimensions of the print to be mounted. They are covered on one side with the manila paper, which is turned over the edges and corners, and laps over the opposite side about 1½ inches. This had better be done at the bookbinder's where the board is cut. As soon as received, the boards should be varnished on the covered side and edges with white shellac, so that this side may be washed as well as the blueprint. A hole should be punched through the board near one edge, and a brass grommet inserted. One having a 5-16-inch hole is about right. A punch for cutting the holes in the strawboard, a tapered punch for expanding the grommet, a small steel block with a hole through the center, the end slightly cupped to fit the grommet, and a hammer are the only tools needed for this operation. Thus prepared the board can be hung on any convenient nail without danger of tearing out.

The blueprint should of course be soaked before mounting, although I did not find this out without some experimenting, and should be hung up so that the surplus water may drip off before placing upon the board. While this is going on, lay the paper down on the manila-paper side, and with a brush apply a border of glue about 1½ inches wide. Prepared glue thinned and warmed until it spreads well is the proper thing. Taking the print by two corners, draw it gently over the edge of the board, until that edge of the print is the proper distance from the edge of the board, then drop carefully upon the board; the edge held in the fingers being the last to touch. If this is done well, it saves many unsightly wrinkles. With a rubber roller, similar to those used for mounting photographs, roll the print from the center toward the edges, to exclude the air and make the print lie flat.

If the print is now dried under a press or heavy weight, so much the better; if not, the manila paper on the back will counteract somewhat the shrinkage of the print in drying, as that is what causes the board to warp, and the boards will thus remain fairly straight.

After drying, give the print three coats of white shellac, which should be thinned with alcohol until it spreads easily. Only a few minutes are needed for the shellac to dry before giving the next coat, so that by the time the last print has received the first coat the first print is ready for the next one.

To some this may seem to be too elaborate a process for such a simple thing as mounting a blueprint, but in this, as in other things, "what is worth doing at all is worth doing well." Mounted in this manner prints not only have a finished look, but are very durable besides.

S. B.

Examination for Marine Draftsman.

The United States Civil Service Commission, Washington, D. C., announces that on January 21, 22, 23, 1902, an examination will be held at various places throughout the country for the position of marine draftsman, light-house service and other similar ones as they may become vacant.

A Department of Commerce.

It is quite evident that a determined effort will be made in Congress during the present session to secure the passage of a bill creating a new executive department to be known as the Department of Commerce and Industries. During the first week of the session six or more bills with this object in view were introduced and referred to the proper committees. That of Senator Nelson, who is chairman of the Senate Committee on Commerce, and a staunch advocate of the proposed department, will probably be selected for enactment. Senator Nelson's bill provides for a secretary of commerce, who shall have a place in the President's Cabinet, and whose province and duty it shall be to foster, promote and develop the foreign and domestic commerce, the mining, manufacturing and shipping industries, the labor interests, and the transportation facilities of the United States; and to this end the department shall be vested with jurisdiction and control of the departments, bureaus and branches of the public service which have heretofore had control of these matters. A branch of the proposed department, to be known as the bureau of manufactures, is to be vested with the duty of promoting and developing the various manufacturing industries of the United States, and markets for the same at home and abroad, by gathering and supplying all available and useful information concerning such industries and such markets.

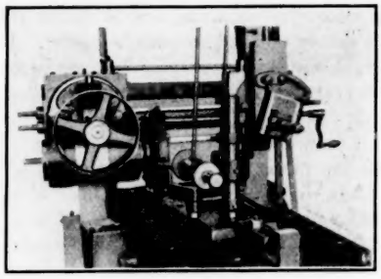
The need for this new department was well expressed in the resolutions adopted by the recent National Reciprocity Convention. President Roosevelt also recognizes the great and growing need for the new department and in his first message to Congress strongly recommended its creation "for the purpose of broadening our markets, securing our business interests on a safe basis, and making firm our new position in the international industrial world."

A. F. TENNILLE.

Some New Things.

A PORTABLE MILLING CUTTER GRINDER.

None of our readers who have had experience with milling will deny the importance of having every tooth of the milling cutter so ground that it will do its full share of the work. We all know it is usually difficult to get this condition unless the cutter is ground in place where it is to be used. For the purpose of doing the work in this way, the Adams Company, of Dubuque, Iowa, who make a well-known milling attachment for planers, have gotten up a grinding machine, shown by the accompanying engraving, and which is intended to be clamped to the platen of the planer in the manner shown, so as to grind the cutter in place. It is found that for grinding large cutters this is more quickly done than to remove the cutter and take it to a machine, and besides, the results are better. It will be noticed that the

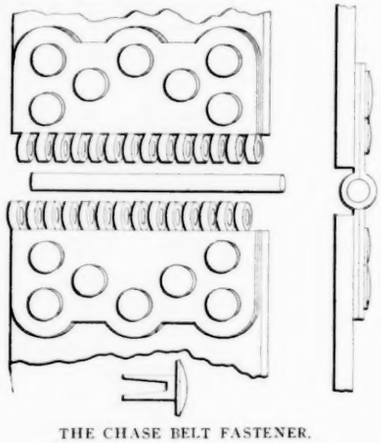


A PORTABLE MILLING CUTTER GRINDER.

machine is very complete in its way, though simple in construction. The wheel is adjusted vertically by slipping the two collars upon the standard, and for fine adjustment the lower one is moved by the screw connecting the two collars, the upper collar being clamped to the standard. The spindle moves through the quill or sleeve in the usual manner, and of course can be set at any angle. The grinder spindle is ¾x11 inches, and is adapted to receive wheels 6 inches diameter and ¾-inch face, with ½-inch hole. The spindle bearing is 5 inches long and is tapering and provided with means for taking up wear.

THE CHASE BELT FASTENER.

The cut shows all the essential features of the Chase Belt Fastener, made by the Chase Company, Lancaster, Pa. The ends of the belt are cut square and the halves of the hinge are fastened on by the rivets, as shown, the rivets requiring no holes to be punched, as they make their own way through the belt without cutting away any of the material or, as is claimed, weakening the belt. The fastenings may be put on with the belt in the most convenient position for the work, and to place the belt in its place on the pulleys it is only necessary to slip in the pin. The fastenings are made in all the required sizes



THE CHASE BELT FASTENER.

from ¾ to 4 inches with rivets to correspond, the rivets used being usually ¼ inch longer than the thickness of the belt. The rivet ends are simply clinched into the leather. If a belt requires shortening it may be taken up as little as ½ inch at a time.

Technical Publications.

S. H. Quint & Sons, of Philadelphia, Pa., who are manufacturers of baggage checks and similar devices, have published a book entitled "American Baggage Check System." This is understood to have been written by the general baggage agent of one of the largest railroads in America, and while we do not profess to be experts in the line of baggage checking and handling, it seems to us from a cursory examination of the book that it very thoroughly covers the subject. Its price is 50 cents.

"Easy Lessons in Mechanical Drawing and Machine Design." Parts 17 and 18. By J. G. A. Meyer and C. G. Pecker. Industrial Publishing Company, New York. Price, 50 cents each.

Our readers are well aware that the publication of this serial, which our former associate editor, Mr. Meyer, looked upon as the crowning work of his life, was interrupted by his untimely death. It is, however, being continued by Mr. Pecker, who was Mr. Meyer's assistant in the work, and we are unable to see that it has lost anything by the change. The present parts discuss the subjects of Beams, Columns, Belts, Pulleys, Screws, Riveted Joints and Gearing.

An interesting point was raised in connection with the troubles at McKeesport, Pa., incident to the recent steel strike. The United States Steel Corporation announced that they would remove the W. De Wees Wood plant from that town, whereupon it was reported that the municipal bondholders were thinking of trying to enjoin them from so doing. Such an injunction would probably be applied for on the ground that the plant was established there in consideration for certain bonuses or immunities, to pay for which the town issued bonds, and that these would be depreciated in value if the plant were removed. It is a very common thing for manufacturing companies to receive important subsidies or privileges as inducements to locate in a particular place, and it would be a matter of interest to determine whether they have a right to pull up stakes at any time and thereby leave the community without the benefits supposed to be bargained for when the plant was located. There is a great variety of circumstances in the different cases, but it would be a novelty to see any of them carried into the courts.

The "Marine Review," of Cleveland, Ohio, began the publication in its issue of December 12, of the biography of the Hon. Peter White, of Marquette, Mich., or, to put it more correctly, began to relate the history of the discovery and development of the iron regions of Lake Superior. He was with the first handful of white men who penetrated the wilderness of the upper peninsula of Michigan. He was there when the first iron mine was discovered

and is there yet. These ore deposits are what gives the United States Steel Company its indefinitely strong position. The facts as told in the "Review" will be brought down to date. Many of them are hitherto unpublished. The narrative will run through three numbers.

A machinist in a large textile machinery building shop once desired to copy some drawings. Having no tracing paper at hand, he saturated some thin writing paper with turpentine and benzine. Boiled oil was mixed with the other ingredients to prevent too rapid evaporation. Some of this paper was left in a zinc tube; it had proved rather too oily for immediate use, and the machinist thought that he would keep it until part of the oil had evaporated. One morning a slight fire in the drafting room was extinguished by the watchman. It was found that one end of the zinc tube was completely melted, the paper was burned, and there seems to be no mistake about its being the cause of the fire. It came to light afterward that the tube had been left open, the cap not being placed upon it when the paper was laid away.—"Insurance Engineering."

It is reported that Emperor William is interesting himself in the matter of beer drinking in German industrial establishments and that by his direction inquiries are being made into the effect of beer drinking during working hours upon the quantity and quality of work turned out

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The American School of Correspondence, Boston, Mass., is able to offer each year a few free scholarships in engineering and mechanical subjects. The scholarships for 1902 are now at the disposal of the trustees and applications will be considered.

Personal.

Albro H. Davis, formerly connected with the Fairbanks-Morse Company of Chicago as traveling representative, will hereafter represent the American Machinery Company, of Grand Rapids, Mich., in and about New York city.

Obituary.

John G. Baker, a manufacturer and inventor of varied experience, died in Philadelphia, December 8, sixty-eight years old. Mr. Baker was born near Princeton, N. J., and served an apprenticeship as a carpenter, after which he was employed as a model maker in the Patent Office at Washington. While living in that city he invented a machine for making glazier's points, which later he modified or developed into a machine for toothing saws. This came to the notice of Henry Disston, and Mr. Baker was employed at the Disston saw works for about five years. In 1864 he became interested with T. Henry Asbury in an invention for the measuring of liquids, and the Enterprise Manufacturing Company was developed from the partnership.

There has recently come to our notice a little English book containing the wire and sheet gages of the world. It gives in parallel columns the numbers under the respective systems coresponding to diameters in 1000ths of an inch, in 128ths of an inch, where applicable, and in millimeters. The gages compared are as follows: American W. G.; New Standard W. G.; Birmingham W. G.; Stub's Iron W. G.; Lancaster Pinion W. G.; Needle W. G.; Music W. G.; Paris P. Gage; Japy Gage; Present Westphalia mm. Nos.; Altena or Old Westphalia Stiftdraht Gage. There is an appendix containing the Sheet and Hoop Iron Standard Gage, or B. G. Gage; the B. M. G. or Birmingham Plate Gage; and Norton's Spindle Gage. This little book was compiled by C. A. B. Pfeilschmidt, of Sheffield. It bears the name of Arthur Lee & Sons, Ltd., of that city, and of L. Upcott Gill, 170 Strand, London, W. C. The price when the edition of 1895 was brought out was 1 shilling.

New Corporations.

The Jackson Knife & Shear Co., of Tremont, Ohio.; object, manufacturing cutlery, etc.; capital, $325,000.

The Napier Saw Co., of Rochester, N. Y.; capital, $25,000. Directors: W. H. Tobey, C. N. Pratt and Charles Napier, of Rochester.

Vehicle Repair Co. of America, New York city; capital, $100,000. Directors: F. C. White, J. H. Burton and L. F. W. Wallace, of New York city.

National Automatic Needle Co., of New York city; capital, $200,000. Directors: G. A. Manwaring, R. C. Wooster and A. H. Pryde, of New York city.

Lanser Filter Co.; principal office, 185 Montgomery street, Jersey City, N. J.; object, manufacturing filters; capital, $100,000. Incorporators: H. C. Evert, H. G. C. Thornton and Geo. R. Allison.

Shrewsbury Motor Works Co.; principal office, Fair Haven, N. J.; object, manufacturing motors, etc.; capital, $25,000. Incorporators: Aug. V. Evans, Clarence C. Smock and Warren H. Smock.

The Page Woven Wire Fence Co.; capital, $6,000 000; object, manufacturing and dealing in all kinds of wire and wire fences. Incorporators: Fredk. P. Swift, Jay Charles Davis and John Milton Ferry.

National Dough Cutting & Scaling Machine Co.; principal office, 62 Astor street, Newark, N. J.; object, manufacturing machinery, etc.; capital, $50,000. Incorporators: James Park, Abraham Kaiser and Henry Hahn.

New Century Engineering Co.; principal office, 419 Market street, Camden, N. J.; object, manufacturing fuel-saving device; capital, $100,000. Incorporators: Floyd D. Maxfield, Hamilton B. Sharp and John A. MacPeak.

Imperial Expanded Metal Co.; principal office, No. 419 Market street, Camden, N. J.; object, manufacturing fireproofing materials, etc.; capital, $250,000. Incorporators: Aug. M. Eddy, Chas. W. Hills, Anna B. Hills, Louis J. Delson.

New Century Hook & Eyelet Co.; principal office, No. 111 Market street, Camden, N. J.; object, manufacturing hooks and eyelets; capital, $125,000. Incorporators: James L. Poalk, James Harshaw, Chas. W. Croasdill, Henry C. Thornton.

H. W. Johns-Manville Company, of New York city; object, manufacturing asbestos wares; capital, $3,000,000. Directors: T. E. Wing, H. E. Ballantyne, G. W. Davenport, Robert Dickson, H. M. Wolfe, E. T. Ross, F. W. Knathoff and H. S. Burroughs, of New York, and W. W. Orr, J. W. Thayer and M. B. Thayer, of Scarsdale, N. Y.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Gear Wheels, gear cutting. Grant; see p. 28.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Eye Benders. Estep & Dolan, Sandwich, Ill.

Wanted—Improvements in grinding machinery. Address Box 1435, Providence, R. I.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas, Bridgeport, Ct. Send for index sheet.

Models, machinery and experimental work made and repaired. Messerer, 24 Boudinot st., Newark, N. J.

For Sale—No. 0 Bickford radial drill with tapper, almost new. W. W. Flickinger, 11 Otter st., Franklin, Pa.

"Brandt's Triple Expansion Gaskets" are the best for boilers. Randolph Brandt, 38 Cortlandt st., New York.

Special tools, models, fine light mach'y and foundry work wanted. Murray Mfg. Co., Richmond Valley, Staten Island, N. Y.

Wanted—An interest in, or will buy outright, a metal working plant; have option on a profitable specialty that could be combined; East preferred. "Plant," care AMER. MACH.

Rubber manufacturer, overstocked on solid and pneumatic carriage tires, wishes to exchange for machinery used in manufacture of rubber goods or regular metal-working machinery. Box 284, AMERICAN MACHINIST.

Purchaser for small manufacturing plant; lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Madison, Wis.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

Rasping machine for carrots wanted; the capability of the machine must be that of a grater; please send sample (about 1 lb.) of the grated carrots as well as catalog; also wanted a fruit presser. Fernando Boldt, Copenhagen, Denmark.

$35,000 extra capital wanted in an old-established New York city mill-supply business; chance of the century for mechanic or hardware man; partner retiring on account of extreme age; others will remain if wanted. Address "Opportunity," care AMER. MACH.

The annual meeting of the stockholders of the American Machinist Press, for the election of five directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the office of the company, No. 218 William st., in the city of New York, on the 13th day of January, 1902, at 12 o'clock noon.
A. LEIGHTON DONNELL, Secretary.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be de-

American Automatic Lubricating Co.; address, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing lubricators, etc.; capital, $1,000,000. Incorporators: Horace S. Gould, Raymond Newman and K. K. McLaren.

Newhouse Wheel Co.; address, Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing car wheels, etc.; capital, $2,000,000. Incorporators: K. K. McLaren, Horace S. Gould, John I. Billings, Evan J. Dudley and Raymond Newman.

New Catalogs.

The American Tool Works Company, Cincinnati, has sent out a little pamphlet containing illustrations of its gold medal tools at the Paris Exposition. It shows two lathes, two radial drills, a planer shaper and a boring and turning mill. Size of pamphlet, 6x6 inches.

We have received from the Star Dynamo Works, Jefferson City, Mo., a catalog of direct current bi-polar and multi-polar dynamos. The sizes, so far as particularly set forth in the catalog, range up to 15 kilowatts. The pamphlet is 6x9 inches, standard size.

The Sprague Electric Company has published a new pamphlet of illustrations showing the applications of Lundell motors to printing office machinery of various sorts, to Gould & Eberhardt shapers, to fans, pumps, die presses, etc. Size of page, 7x9¼ inches.

We have received a pamphlet describing the hot-water system of exhaust heating controlled by Evans Almirall & Co., engineers and contractors, 44 Dey street, New York. Among other things the pamphlet shows a few of the many buildings in which the system is employed. A contract has just been closed to install it in the new Allis-Chalmers shops. Size of page, 9x6 inches.

The Philadelphia Machine Tool Company, 445 North Darien street, Philadelphia, Pa., has sent us a copy of the lines of sheet metal working machinery of which it is designer and builder. These include presses, rolls, etc., for punching, stamping, trimming, shearing, embossing, bending, forming, straightening, riveting, drawing, spinning, etc.—a good-sized assortment. The pamphlet is 5x6¾ inches.

The Seyhold Machine Company, Dayton, O., has sent us a copy of catalog of unusual excellence in get-up. The company are manufacturers of machinery for book binders, printers, lithographers, paper box makers, paper mills, paper houses, etc. The catalog shows a line of paper cutters for various purposes, automatic knife grinder, die presses embossers, stampers, smashing machines, etc. It is bound with stiff cover and is 8x10½ inches.

The Hoggson & Pettis Manufacturing Company, New Haven, Conn., has published a new edition of its catalog of the Sweetland combination, universal and independent chucks, the Sweetland standard independent chucks, geared scroll chucks, face-plate jaws, chucks for special work, Porter belt tighteners for lacing, screw cutting die heads, a line of scales, surface gages, etc.; toolroom checks, steel letters and figures, etc. The catalog is 4¾x7¼ inches.

A tasteful vest-pocket catalog, with prices, has been published in a new edition by the Whitman & Barnes Manufacturing Company, Akron, O., manufacturer of machine shop and factory supplies. It covers a miscellaneous line of supplies, including twist drills, taps, reamers, milling cutters, spring cotters and keys, wrenches, files, hack saws and blades, rubber and leather belting, lace leather, sheet packing, matting, valves, mechanical rubber goods, etc. Size, 3½x6 inches, small standard.

Wants—Continued.

stroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Experienced typewriter man wishes a position. Address W. J. Reeves, Highspire, Pa.

Experienced draftsman, 23, desires position with manufacturer of machinery. Box 287, AMERICAN MACHINIST.

First-class mechanical draftsman and designer, technically educated, wants change: New York city only. Box 299, AM. MACH.

Mechanical draftsman, 22 years, graduate of the International Schools, desires position; East or West. Address Box 292, AM. MACH.

Young man, having 6 years' drafting and machine shop experience, wishes position as assistant to chief engineer or master mechanic. Box 293, AMERICAN MACHINIST.

Mechanical engineer, experienced in designing automatic machinery, wishes position as designer or constructor; competent to take full charge. Box 294, AMERICAN MACHINIST.

A practical superintendent or general foreman, of 20 years' experience in up-to-date machine shops, expert in tools, dies and jigs, open for engagement January 1, 1902. Box 288, AMERICAN MACHINIST.

First-class gasoline engine man will be open for engagement January 1, as superintendent of construction or general foreman; automobile work preferred. Address "Compression," care AMERICAN MACHINIST.

Mechanical engineer, with practical experience, graduate of Polytechnical School at Stuttgart, Germany, desires position as draftsman; available about January 20, 1902. Address C. W., care AMERICAN MACHINIST.

Situation wanted by a mechanic; has been superintendent of a machine shop for 15 years; employed in same concern 20 years; used to piece-work system, making tools, jigs and machinery for getting out work cheap; can give good reference; man of good habits; 41 years old; American; single. Address Box 289, AMERICAN MACHINIST.

A mechanical engineer (member of A. S. M. E.), graduate leading technical college, 15 years' experience in machine design, mill engineering and high-pressure steam power transmission, as well as superintendence of construction, seeks position as head draftsman or chief engineer of consulting or contracting engineering office or manufacturing establishment; New York or Boston preferred. Address Box 290, AMER. MACH.

Help Wanted.

Wanted—Accurate machinist for marine engine work. Apply Ward Engineering Works, Charleston, W. Va.

Wanted—First-class machinists on engine work; no labor trouble. Address Reeves Machine Co., Trenton, N. J.

Good wages for first-class machinists for heavy floor and machine work. Apply Allis-Chalmers Co., Scranton, Pa.

Wanted—Corliss engine draftsmen; experience and reliability essential. Apply to the Filer & Stowell Co., Milwaukee, Wis.

Wanted—First-class toolmakers, experienced on jigs, punch and die work. Apply to Richmond Electric Co., Richmond, Va.

Wanted—A man familiar with hardening and tempering dies, cutters, etc. Apply, stating wages and experience, Box 297, A. M.

Good patternmakers, both wood and metal, desiring steady employment, will find it to their advantage to apply to the General Electric Co., Schenectady, N. Y.

Wanted—Number of patternmakers, experienced on compressor or steam engine work; none others need apply. Franklin Air Compressor Co., Franklin, Pa.

Wanted—At once, experienced draftsman and tracers for detail work; state experience and salary expected. De Laval Steam Turbine Co., Trenton, N. J.

Experienced draftsman wanted on mill machinery and machine tools. Permanent employment assured to rapid and accurate draftsman. Bethlehem Steel Company, South Bethlehem, Pa.

Wanted—A number of mechanical draftsmen on iron and steel works machinery, furnaces, etc. Apply to Chief Draftsman, Mechanical Department, Pennsylvania Steel Company, Steelton, Pa.

Wanted—Office manager for factory; must be competent to take charge of all office work, including cost calculation and pay roll. Only applicants having experience address Box 285, AMERICAN MACHINIST.

Wanted—A machine shop foreman to take charge of a shop employing about 75 men, building steam hammers and special machinery; a good place for a live, hustling mechanic. Box 286, AMERICAN MACHINIST.

Wanted—Competent foreman boilermaker, who is capable of making estimates; boilers, sheet iron work, etc.; must be attentive to business and sober; full particulars by correspondence. Address A. G., care AM. M.

Wanted—An experienced mechanical engineer to take charge of all machinery operated by mining and furnace company; only first-class man, with best of recommendations, need apply. Address G. I. C., care AM. MACH.

Wanted—Good mechanical draftsman for position in Chicago; one experienced in can-making machinery and sheet metal tools preferred; good opening for right party; give references and salary expected. Box 281, A. M.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Practical man, competent to take charge of thoroughly equipped foundry and machine plant, in thriving Western city; one who can command $3,000 or $4,000 capital, to take controlling interest. Address C. C. C., care AMERICAN MACHINIST.

Wanted—A good draftsman and expert machinist; one who can work on experimental work when not engaged at the drawing board; state nature of past experience, age and salary expected. Victor Talking Machine Co., 114 N. Front st., Camden, N. J.

Wanted—Foreman to take charge of machine shop, employing about 15 men, manufacturing wood-working machinery; location, small town in Ohio; applicants please give age and experience; sober man only need apply. Address C. M. C., care AM. MACH.

Wanted—Foreman for a small shop manufacturing transmission machinery in the South; a man well up in the manufacture of iron pulleys, hangers, etc., will find a permanent position; give references and state experience. Box 296, AMERICAN MACHINIST.

Wanted—A man to take the position as foreman in our machine shop; he must be qualified to take charge of men and familiar with machine tools in general; would prefer a man who has had some experience in the construction of gasoline engines, although this is not absolutely necessary. Box 295, AM. M.

A New York factory contemplating additions to their drafting force desires applications from experienced draftsmen and tracers for electrical, switchboard and instrument work; state experience, salary expected and how soon at liberty; permanent positions to satisfactory men. Box 232, AMER. MACH.

Wanted—A thoroughly competent mechanical engineer to take charge of drafting room of a concern manufacturing a full line of mining machinery, except steam engines and boilers. Address, giving full information as to past experience, references and salary expected. Address "Mining," care AM. MACH.

Wanted—Foreman for a brass department containing 50 hands, in a large electrical factory; must be familiar with parts of electrical apparatus and with modern methods of production and know the entire details of the workings of such a department. Apply, giving full particulars as to experience, salary expected, etc., to Box 258, AMER. MACHINIST.

Real Estate Wanted for Factory Purposes

Wanted—To lease or buy, a modern factory building with large window area, with accommodation for 300 machinists, for fine machine work; must be situated east of New York, have ground for additions and good shipping facilities. Address Dow Composing Machine Company, 13 Park Row, New York City.

MANUFACTURERS.

Would like to correspond with concern manufacturing machinery and machine tools, who have an opening in their sales department for an energetic young business man (28); experienced toolmaker, with a successful career as foreman and superintendent. At liberty January 1. Good references. Address Box 298, AMERICAN MACHINIST.

Counting Wheels.
SMALL GEARS.
Ask for samples and prices.
FRANKLIN MFG. CO.
Syracuse, N. Y.